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The Commissioners' Report.

THE annual reports of the Electricity Commissioners are presumably intended to be indicative of the progress achieved in co-ordinating and extending the electricity supply resources of Great Britain. The eighth of the series, extracts from which will be found elsewhere in this issue, covers the year ended March, 1928, thus conforming to practice in Government publications; belated issue is obviously better than none at all, while developments during the intervening eleven months are hinted at in various footnotes, though some of the statistics relate to 1927. It must be admitted though that the year under review was one of exceptional pressure upon the time of the Commissioners and their staff. In addition to the more urgent matters arising from the Electricity (Supply) Act, 1926, and their administrative duties, they devoted considerable attention to what they describe as the "problem of facilitating and expediting the supply of electricity in rural areas." Those circumstances rendered it necessary for them to defer consideration of a number of matters which were not immediately pressing and, we are told, contributed to the delay in issuing the Report.

During the eight years that have elapsed since the reorganisation of the country's electrical facilities was commenced it has become increasingly evident that the centralisation of generation will require to be supplemented by improved and co-ordinated distribution, and the persistent growth of the demand of the rural population for better amenities impelled the Commissioners to emphasise that the practical possibilities must be affected by a variety of factors; while they concede that developments in other countries afford a general indication of the potentialities, they point out that rural electrification in Britain must conform to British conditions. Quite so, but what are our conditions? Do they include such factors as rules and regulations sympathetically framed to stimulate economic distribution, which is essential if the sparsely populated countryside is to be adequately provided with electrical facilities? The Report demonstrates at length the fact that the areas which remain to be developed consist mainly of the more thinly inhabited country portions, amounting to 45 per cent. of the whole area, but supporting only 5 per cent. of the total population, with

the low average density of 56 persons per square mile; yet we seem to have heard of more than one part of Europe whose equally rarefied population is in full enjoyment of electrical amenities. Yes, Continental practice seems to have been economic and adequate, if not exactly elaborate, and we shall do well indeed to cultivate the faculty of discerning merit in the accomplishments of others.

It is satisfactory to learn that the sale of electricity by authorised undertakers in 1927 increased by 19.6 per cent., compared with the 1926 figure, and by a total of about 88 per cent. during the five years since 1922. With the estimated population at the end of 1927 as a basis, the average consumption per head of population is calculated as 155 kWh; but, as has frequently been pointed out before, public supply stations represent but a portion of the total production resources of the country, for privately-owned generating plant, which has been installed on a widespread scale, does not come within the scope of the statistical returns which the Electricity Commissioners are empowered to obtain. However, some indication of the extent of the generating plant installed for industrial purposes is afforded by the preliminary reports on the third Census of Production issued by the Board of Trade; but they were issued in 1927 and relate to 1924, while they do not embody particulars of the production of electricity by the generating plant of industrial organisations, and, moreover, they do not include plant employed wholly, or mainly, for transport services. Nevertheless, the private output must represent a substantial contribution to the annual consumption, for it is apparent that the generating resources of trade and industry added some 65 per cent. in 1924 to the resources of the authorised undertakings.

It is comforting to recall the rapid recovery, as regards output and operating results, of the supply industry from the deplorable effects of the prolonged coal miners' dispute. The energy generated nearly reached 10,000 million kWh, an increase of over 18 per cent. on the 1926-27 figure, and it should be noted that the greater output was obtained with an increase of only 5.4 per cent. in the quantity of solid fuel consumed. Incidentally, it is of interest to record that the return to more normal conditions was accompanied by a diminution of the use of fuel oil.

The Report and its numerous appendices are much too lengthy to be abstracted otherwise than very briefly: it reviews the then overhead-lines wayleaves position and, *inter alia*, contains copious notes on the subject of Special Orders, the Commissioners having modified somewhat their Statutory Rules of 1920 with the object of simplifying their procedure and reducing the expense to applicants.

"Service" and Co-operation.

Throughout the speeches at the recent annual dinner of the Electrical Wholesalers' Federation, Ltd., the keynote was co-operation in industry, different speakers dealing with different phases of the subject, while Sir Philip Nash, K.C.M.G., chairman of the Metropolitan-Vickers Electrical Co., Ltd., struck a particularly welcome note—that of "co-operation in the workshop." He strongly advocated a policy which has been practised by his company for the past eleven years, of close and real co-operation between the management and workers.

Any scheme which has for its object such co-operation can only be successful when there is genuine sympathy on the part of the management—one that will help the operative to understand the difficulties of the inner working of the concern by which he is employed.

There is one field in the electrical world, the distribution side of the supply industry, where co-operation between the management and the workers should prove particularly fruitful. The prevailing idea in the supply undertakings to-day is service, and there is an army of men employed whose "product" is service. These men undoubtedly come into closer contact with the consumer than the management, and they actually appear to the consumer as "the supply authority." They have a unique opportunity of gaining for the undertaking the confidence of the consumer—an asset of inestimable value—and, in their conversations with the consumer during the progress of their job, can do very much indeed in the way of propaganda and business-getting.

The idea is not untried, and where it has been put into operation in a few cases in the electricity supply industry, and to a much greater extent in another important public service, it has proved conspicuously successful: but without the backing of the management—a backing which can only be born of the closest co-operation between the two parties in question, compatible, of course, with adequate discipline of the worker and prestige of the undertaking—the advantages of such a liaison as that referred to cannot be obtained.

Co-operation "in Bulk."

We are afraid that we have no great reserves of enthusiasm to expend upon proposals that are occasionally advanced for bringing all the organisations connected with the electrical trade under one umbrella, or into one associated whole. It is something when a single association representative of a particular section finds it possible for all its brethren to dwell together in harmony; it is better when two or three such can link up for the purpose of gaining special ends; but to expect sweeping movements to bring all together, save for the adoption of a simple general principle or a pious aspiration, is to look for something more than human. The idea has been so often advanced in different days and has been developed to some extent in differing forms, with little ultimate good result, that, though times are not what they were, we cannot find in our knowledge of the past promise of any greater success being secured in what everybody must admit are in many ways more difficult days. The reconciling of conflicting interests is an end greatly to be desired and one well worth working for, but let us secure peace and agreement within the separate sections before we hope too much for a peaceful consolidation of many sections in each of which common agreement makes much tarrying.

At the Fair.

It is very difficult to generalise regarding an exhibition of the size and variety of the British Industries Fair; all that can be drawn in the way of conclusions must necessarily be based upon prominent features observed here and there.

It may be said, however, that the electrical industry has put up a good show this year and surpassed the efforts of preceding years, a result for which the committee of the Electrical Section deserves a great deal of credit. If there is any criticism to offer it is that there is too much for the visitor to "take in" properly. The products of the electrical industry are so many and varied that complete classification is impossible, and many really good things may be missed in a multiplicity of apparatus and appliances. In this respect the gas industry appears to be more fortunate; manufacturers do not produce so many different lines, and some sort of co-ordination is possible.

Among the features which show the ability and willingness of our electrical manufacturers to fulfil one of the first requirements of salesmanship—the study of the customer's needs—is the "Colonial" or "Empire" type of electric cooker, which is shown for the first time by three or four companies. These cookers, which are admittedly designed to meet American competition, possess all the advantages of their Transatlantic prototypes without being cheap imitations, and to quote the hackneyed phrase should "meet a long-felt want" in the Dominion markets.

We shall be able to say more regarding the results of the Fair in a later issue; so far the reports have been to the effect that business has been fairly good.

A Himalayan Hydro-electric Scheme.

The electricity works of the Mussoorie City Board has a water-power capacity of 3,000 kW, and provision is made for 6,000-V transmission.

By G. O. McLEAN, M.Eng.

IT has been estimated that India has available in water-power more than 5 million horse-power, of which only about half is developed at present. Large schemes, which have been described in the technical Press, are those of the Tata Power Companies in the Bombay Presidency; the Cauvery and Mettur power

Fig. 1.—General View of Mussoorie.

schemes in Mysore State; and the Sutlej hydro-electric scheme (under construction) in the Punjab. In the North-East are the great Himalayas, with their perpetual snow, in which all the Ganges' tributaries have their source. One would expect to find several hydro-electric stations there, and most of the towns do have their own stations; but as the load is only lighting, and none of the hill-stations have more than 20,000 inhabitants, the power schemes are necessarily small. One of the largest is owned by the Mussoorie City Board, and the writer had an opportunity of visiting

Fig. 2.—Mussoorie Power Station.

it recently, through the kindness of Mr. Bell, the city electrical engineer.

Mussoorie is one of the many hill-stations of the United Provinces, 6,500 ft. above sea-level, and one of the most popular health resorts of the wives and children of the European population from April to October, when the heat on the plains is intense. The railway runs to within 14 miles of Mussoorie, to Dehra-Dun, the headquarters of the Indian Government's Forestry Department and Trigonometrical Survey. This town also receives its supply from the Mussoorie Board's station at Galogi.

Fig. 1, a general view of Mussoorie, gives an idea of the topography of the land over which the h.p. lines have to be taken. The power station, fig. 2, is situated at the foot of the range of mountains on which Mussoorie is built, and is about 6 miles from the latter and 8 miles from Dehra-Dun. The source of power is the Kiarkuli Nadi, a tributary of the River Jumna, itself a tributary of the great Ganges.

At a point 1,000 ft. above the station level and about 2 miles distant, the river is dammed and diverted through strainers into the intake reservoir or forebay (fig. 3) which holds about 29,000 cu. ft. From the further end of the reservoir, where are more screens and sluice valves, start the penstocks and two 24-in. diameter pipes. These follow the course of the river-bed, more or less, crossing and re-crossing it only once. As the fall is fairly gradual and there are no sudden changes of load, there is no fear of water hammer, and consequently no need for a surge tower, the intake reservoir or forebay taking its place. This reservoir is overflowing all the year round, more or less, dependent on the demand on the station.

The scheme was started in 1909, the civil engineering work being done departmentally; Messrs. Bruce Peebles & Co., Ltd., put in the first set of 150 kW capacity. The present station contains two 500-kW 3-phase Siemens alternators, generating at 6,000 volts and driven by Pelton wheels (J. Gordon), needle-governed; and two 1,000-kW, 3-phase alternators (Metropolitan-Vickers) driven by Pelton wheels, with needle and deflector governing. The Metro.-Vick sets generate at 400 volts, and there are two banks of transformers stepping up to the bus-bar pressure of 6,000 volts.

The switchboard is also by Metropolitan-Vickers, there being 4 machine panels and 4 feeder panels; all switches

Fig. 3.—Dam and Intake Reservoir.

are hand-operated. Transmission is by 3-wire, 3-phase, at 6,000 volts, overhead lines, there being 2 feeders to Mussoorie, and 2 to Dehra-Dun.

The station lighting, workshop motors and local distribution is at 440 volts, 3-phase, 4-wire. The town supply and house service at Mussoorie is also at 440 volts, 3-phase, 4-wire, there being about twelve small sub-stations scattered about the city. Up to the present, the maximum demand on the station has not exceeded 700 kW, but it is growing.

Our Overseas Electrical Markets.

Economic Conditions in Australia, New Zealand, South Africa and India.

In the following article is given a survey of commercial conditions in the principal overseas markets for British electrical material, accompanied by charts showing the trend of imports into each country of such goods in recent months, based on the latest official returns available. It has always been the policy of this journal to direct attention in every possible way to export trade, on which the prosperity of this country so greatly depends. By examining the statistics of the electrical trade throughout the world, which are dealt with systematically nearly every week in these columns, manufacturers and exporters can gauge what business is available overseas and what foreign competition has to be met, and can lay their plans accordingly.

Australia.

Business in Australia has improved since the labour troubles in connection with shipping ended. Although unemployment, notably in the building and manufacturing trades, is still above the average, it is lessening as the season advances. Christmas trade was rather above the normal in the principal centres. Banking returns show increased deposits and diminished advances.

If expectations are realised—and there is every confidence that they will be fulfilled—the wheat crop will be considerably better than last season, while the wool crop will be either as high as, or higher than, the unusually large crop of the past three seasons. During the financial year ended June last, in spite of the fact that both the wheat and wool yield were less than in the preceding twelve months, the adverse trade balance was

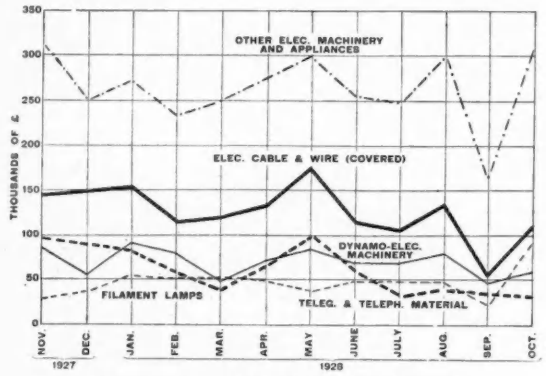


Fig. 1.—Australian Electrical Imports.

considerably reduced, and there is cause to hope that the foreign trade situation will soon show a gradual but steady improvement leading to a satisfactory revival of import trade.

A measure of trust in the ultimate recovery of trade and industry is the fairly wide endorsement of the views expressed by the Tariff Board and the British Economic Mission. The Tariff Board has pointed out that "Productivity should be the basis of all wages, for on it depends the general welfare of the community. There should therefore be co-operation between all parties to bring about this result. Employers should meet competition by the installation of up-to-date machinery and the adoption of the most modern methods, and employés should co-operate with the employers to secure the maximum output under these improved methods." If the conjoint efforts of employers and employés fail to arrive at a satisfactory solution, it would seem to be worthy of consideration whether the Government of the day should not then, after full and exhaustive inquiry, fix the general maximum limit of the rate of tariff assistance which it is considered economically sound to grant to any industry.

The British Economic Mission recommended that, if protection be persisted with, industries should be compelled to justify such special treatment. It is felt that support for a policy of moderate protection will be forthcoming from the new Minister of Customs (Mr. Gullett) whose sympathies are known to be with the agricultural interests.

Following a successful year's operation, as a result of which a small surplus was shown, the Victorian Electricity Commissioners are taking steps to increase the capacity of the plant at Yallourn. Their aim is to have three additional 25,000-kW sets in operation in 1931. The high-voltage transmission line between Melbourne and Yallourn will be duplicated. Now that hydro-electric power is available in north-eastern Victoria, an increased demand may be expected for many different kinds of small electrical apparatus and fittings. An interesting side light on the spread of the use of electricity in New South Wales is afforded by the official statistics of manufacturing industries. The extension of the network is said to have stimulated the sale of power-consuming appliances to all sorts of small workshops.

New Zealand.

A further advance has been made during the past quarter in the recovery in New Zealand business. With

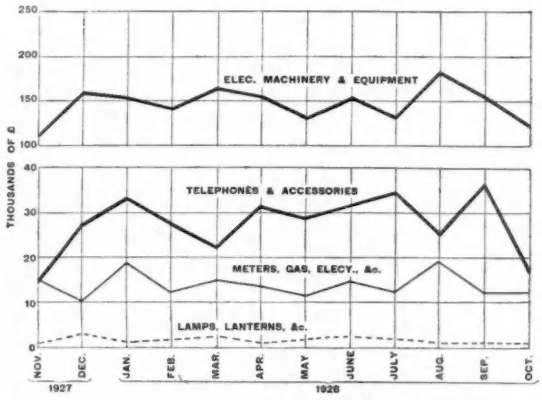


Fig. 2.—New Zealand Electrical Imports.

a few unimportant exceptions the products of the Dominion are expected to return very good yields. The banking situation has been strengthened substantially as a result of the caution exercised early in 1928. The increased wool clip has been partly offset by the lower level of prices realised. Building continues active practically throughout the Dominion.

The foreign trade returns for the twelve months show a favourable trade balance of £11,300,000 compared with one of £3,700,000 only in 1927. Exports were nearly £8,000,000 up, and imports £100,000 higher

Loans are being offered on easier terms than for some time past by both the Government and the banks, and it is anticipated that expenditure on development schemes and constructional work will be on an increasing scale during the current year; in fact, the opinion is widely held that 1929 will be one of the most prosperous in the history of the Dominion. It is disappointing to find that Great Britain's share of the total

trade decreased slightly last year. It still stands, however, at about 47 per cent. At the same time it must not be overlooked that there are signs of a new tendency in the direction of the Dominion's exports which is of some significance. Larger shipments, notably of meat, are going to the United States.

It was recently reported by the British (United Kingdom) Manufacturers' Association of New Zealand that heavy business in electrical goods had been almost entirely confined to Government purchases, practically all of British manufacture. This remark applies also largely to transformers and switchgear. In cables and wires British makers, by lowering prices, have recovered lost ground. Within the past twelve months the New Zealand Government has purchased from British manufacturers machinery and general equipment, chiefly for the New Zealand Railway Department, of a value of approximately £650,000. Four railway workshops are being established, one in each of the chief cities of the Dominion.

Electricity is now available to 1,240,000 persons in the Dominion, whereas ten years ago the number was but 467,000. During the decade the amount of capital invested in hydro-electric enterprises advanced from £1,500,000 to £19,000,000. This great extension of the advantages of cheap power was one of the outstanding points observed during the recent tour of the northern province by sixty leading business men. They found vastly improved conditions in the country districts where electricity was available.

South Africa.

Crop prospects in South Africa showed a marked improvement with the opening of the New Year, owing to the welcome rains in November and December which relieved some prevalent anxiety due to the drought in certain districts last autumn. In some sections, however, rain is still needed. The results of Christmas trading proved very satisfactory, and the general purchasing power of the population augurs well for the trend of import trade in the immediate future.

Railway revenue and Customs receipts remain well up to normal and encourage a continuance of the policy of public works development which the Government has been pursuing for some time. Meanwhile most manufacturing enterprises are well employed. The building trades are still active and all engineering shops are busy.

The resumption of the wool sales in January was

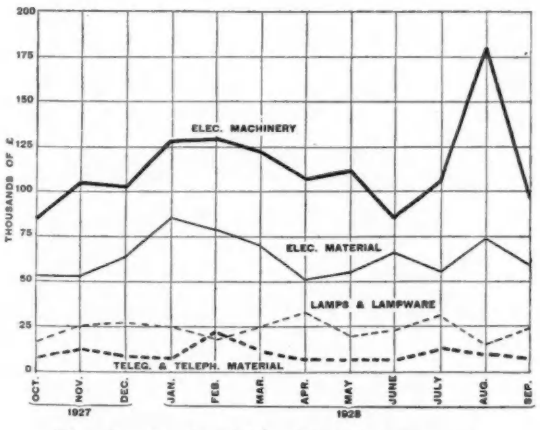


Fig. 3.—South African Electrical Imports.

characterised by well-maintained prices. The favourable tendency is of great significance to the Union to which a rise of a penny a pound in the price of grease wool may mean a gain of £1,000,000 in a year. Gold production for the eleven months was £40,348,500 in value, compared with £39,416,500 in the same period of 1927, while the coal output in the Transvaal, Orange River Colony, and Natal also showed an increase on the previous year.

Finally, foreign trade for the twelve months is expected to show an increase of between £3,000,000 and £4,000,000 in both imports and exports.

India.

India's foreign trade has shown an improving tendency during recent months. Both imports and exports have increased in value compared with the

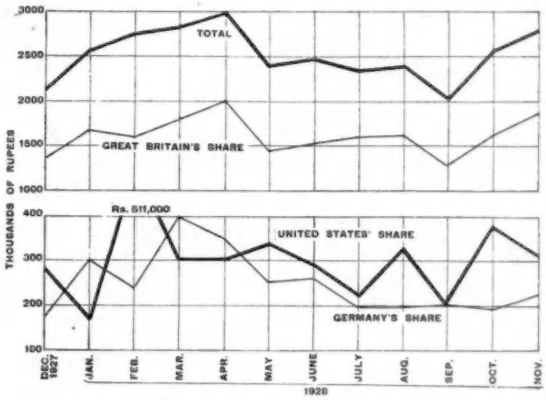


Fig. 4.—Indian Electrical Apparatus Imports.

previous year, and the favourable balance of trade has shown a further advance.

In most districts the weather has been favourable to crops, the condition of which is consequently good excepting the cotton in the Punjab. There is still cause for anxiety in the labour situation, further disputes being feared. This uncertainty will, it is thought, prejudicially affect the demand for engineering material in the near future, but on the other hand, there is considerable activity in prospect on the part of the Government in the direction of public works.

In an interesting survey of the effect of electric power on Indian industrial development which appeared recently in *Capital*, it was pointed out that the most promising field in India for the electrical engineer was

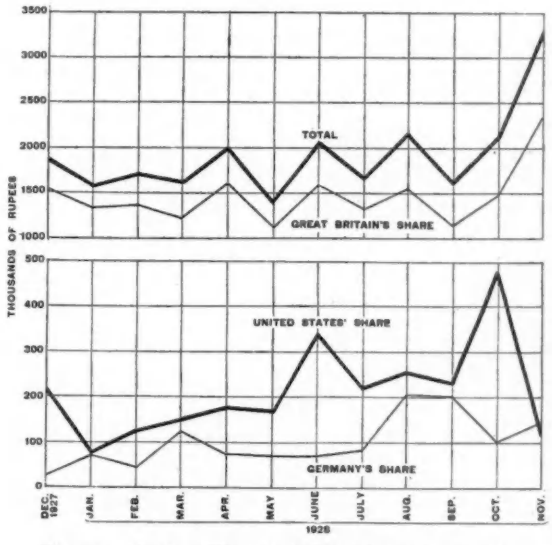


Fig. 5.—Indian Electrical Machinery Imports.

Madras. Despite the abundant water power resources in that Presidency the annual consumption of electricity per head of population was very considerably below 100 kWh which might be considered normal for such an area. Electric lighting and power plant with steam or internal combustion prime movers was being gradually established, but what was needed was distribution on a large scale at attractive rates. There were indications that the authorities were seriously taking

up the question of exploiting the hydro-electric resources of the area on the lines of the programme drawn up by the recently formed Hydro-Electric Department. There is every likelihood that the Pykara project, which will be capable ultimately of yielding over 100,000 h.p., will be sanctioned in the near future. In that event energy should be available in 1931. Meanwhile, work has been started on a station for supplying power to the Pykara construction works as soon as necessary, to Ootacamund, Coonoor and other towns, and to the neighbouring tea estates. The Pykara project is intended to supply the Nilgiris, Coimbatore, Tiruppur and eventually Calicut, Cochin and Madras. It will also be extended to Trichinopoly and Madura. Careful consideration will be given to the needs of the agricultural districts, a special rate being proposed with a view to attracting a demand for uses other than pumping and lighting.

In the Punjab attention has been concentrated on the Mandi scheme, in the first stage of which 36,000 kW will be generated, the second stage providing for an increase to 70,600 kW, and the third to a total of 118,600 kW. The first stage would take about four years to complete and would enable about twenty towns in the Punjab to be supplied with electricity, the demand for which is already sufficient to justify the work. Specifications for the pipe line, generating plant and transmission line have been prepared, and the question of tenders will shortly be dealt with in London. In Bengal, while most of the larger towns are already electrified, a number of smaller projects are under consideration.

The Off-peak Heating Load.

Some further notes and figures showing its possibilities to the supply engineer, with particular reference to progress in Switzerland.

By L. G. A. SIMS, M.Sc. (Eng.).

In a contribution on this subject some months ago, the present writer described the advanced stage of development in Switzerland, and the wide and increasing use of apparatus devised to allow the storage and subsequent use of electrical energy in the form of heat.* It was shown, for instance, that by applying the principle to the heating of water, and to a less degree to the heating of buildings, the load factor of one Swiss town was increased between the years 1915 and 1924 from 56 per cent. to 74 per cent., and it was stated that the increased revenue and the wonderful characteristics of a load which can be fitted easily by the supply authority into the off-peak hours were so great that Swiss authorities, without exception, were giving every possible encouragement to its growth.

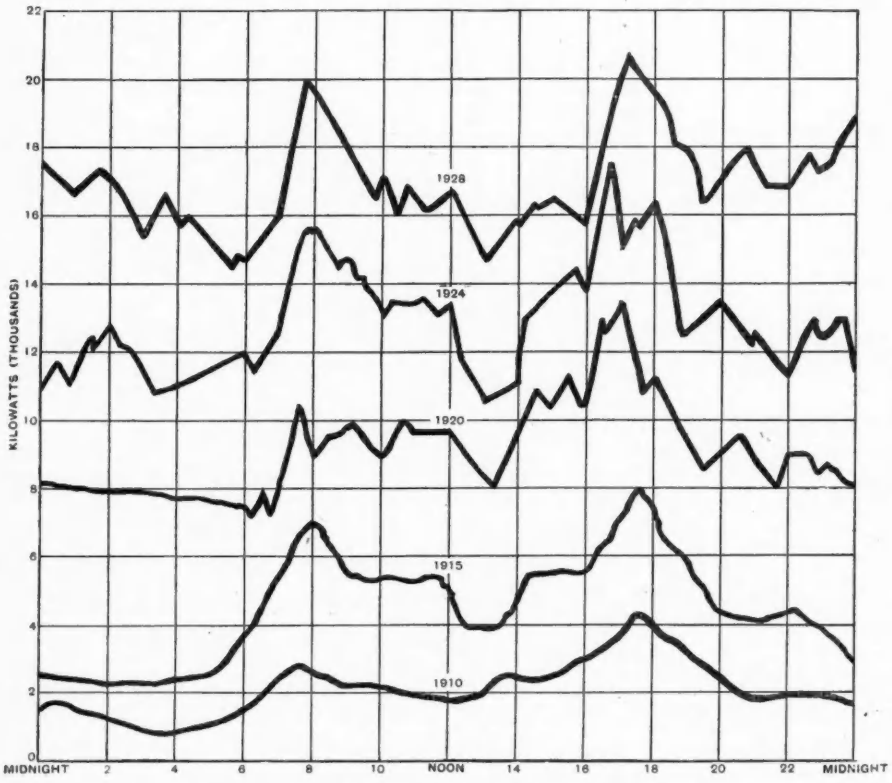


Fig. 1.—Load Curves, Basle, Switzerland.

It is, therefore, surprising to find that, despite the acknowledged benefits to both supply authority and consumer which a heat-storage system can confer, there is still in this country extraordinarily little progress to show. We may take as an example the domestic water-heating load. This is the ideal case of an off-peak load, for, since hot water is a necessity in every household, all the year round, the demand upon the station is steady, whilst water itself is naturally an excellent storage medium. Electrical water heating can be made really attractive to consumers with energy costing ⅜d. to ½d. per unit, the energy being taken at these cheap rates only during off-peak hours. Machines and cables which would otherwise be almost idle are thereby kept on load, the supply authority securing a considerable additional revenue. *There are at present in this country about three supply authorities which offer an attractive tariff for this type of load.* Does this mean that the others have no need of an off-peak load, that plant and distribution system are earning as much as possible, or that there is some fundamental objection to a revenue-earning storage system using cheap electricity?

* "The Domestic Storage of Energy," Electrical Review, October 21st and 28th, and November 4th, 1927.

As a case in point, the writer recently installed an electric hot-water storage system with a loading of 1¼ kW, and applied to the supply authority concerned for the terms of any special tariff it might be willing to allow for this load, if run only during off-peak hours. The probable consumption would have been some 2,000 units per annum, which was surely worth encouraging, particularly in the city concerned, where the load factor is bad, but no better tariff was offered than the ordinary domestic rate on which one runs any ordinary daytime load, though the supply authority admitted the great advantage to it of the type of load proposed. This is the present state of affairs in one of our largest cities, and the result in the writer's case is that he may have to curtail the use of the electric system instead of using it freely as he would prefer, whilst other householders, having no interest in a system which does not show a reasonable running cost, will continue to pay their money to the coke and gas sellers.

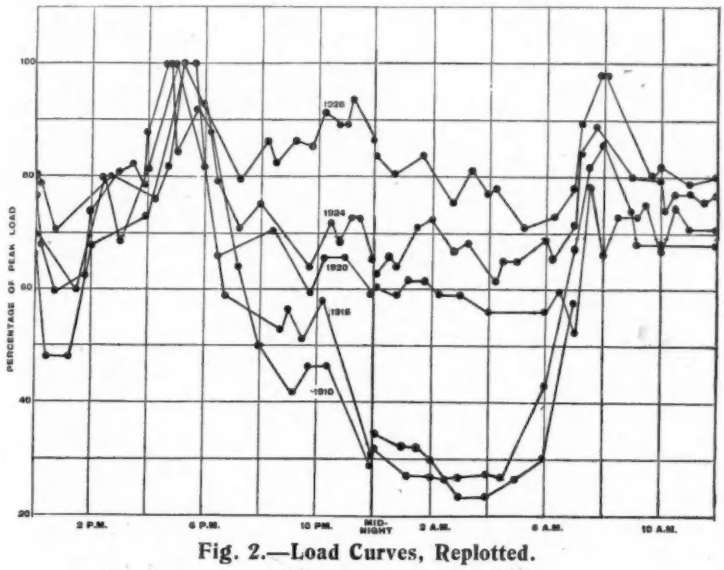


Fig. 2.—Load Curves, Replotted.

If this heat-storage method of improving load factor has been an unqualified success abroad, and if it can be shown to be economically sound to the supply authority here, then surely the time for hesitation and half-hearted experiment has passed. This is the opinion held strongly by certain electrical engineers in this country who have seen at first hand the advantages to all concerned of the scheme when in operation. In order to bring home more strongly and more exactly the nature of the advantages which may accrue to the supply authority, and to assist a judgment to be made upon the possibilities here, statements and figures published in the yearly reports of the Basle (Switzerland) electricity works, kindly supplied by the chief electrical engineer of that undertaking, have been translated and analysed.† It is hoped that the publication in English of some of the more important of these will quicken interest in the subject, and assist in the early introduction of cheap tariffs here.

In Fig. 1 are shown the actual load curves for Basle from 1910 to 1928, taken at corresponding times in the winter of each year shown. That there is a progressive improvement in the load curves will be evident to those who are accustomed to curves of this type, but a more striking demonstration of this is given by a slight re-arrangement of the curves. By expressing the maximum load reached in each case as 100 per cent., the peak values for each year are made to coincide, and the minima can then be more readily compared. If the curves be then replotted, so as to bring the night and early-morning hours—which are, of course, the off-peak hours—together, we get the curves shown in fig. 2. Here, surely, is material for thought and emulation, for the improvement in the shape of the curves so revealed is astonishing. Off-peak heating was commenced in Basle in 1915. Particular interest will therefore be taken in a comparison of the curves for 1910 and 1915 with those for 1920 and later. It is seen that the effect produced by the introduction of heat storage is placed beyond doubt by these curves. It is clear, moreover, that although the system has been working in Basle for more than 12 years, the improvement is still continuing. This is indeed the case as new off-peak heating installations are still being laid down every day. In fig. 3 are given three load curves covering six months of the present year, in order that the seasonal variation in the load curve may be seen.

Furthermore, it is extremely interesting to notice from the Basle electricity works reports how the total heating energy supplied by the undertaking is divided.

TABLE I.—Consumers of Energy for Heating.

	1923.	1924.	Percentage increase.	1924.	1925.	Percentage increase.	1925.	1926.	Percentage increase.	1926.	1927.	Percentage increase.
DAY CONSUMERS.	65	79	21.5	79	85	7.6	85	112	31.8	112	133	18.8
NIGHT CONSUMERS.												
(*a*) Large users with metered load	1,401	1,720	22.8	1,720	2,120	23.2	2,120	2,682	26.5	2,682	3,588	35.1
(*b*) Fixed charge (small) consumers	896	1,235	37.8	1,235	1,670	35.2	1,670	2,143	28.3	2,143	2,830	32.0
Total night consumers ...	2,297	2,955	28.7	2,955	3,790	28.3	3,790	4,825	27.3	4,825	6,418	33.0

There are, of course, two main classes of consumer: first, those who, for one reason or another, still take heating energy during the day, paying the day tariff, and, secondly, those who take it at a special cheap rate, chiefly during the night. The latter are mainly the owners of heat-storage systems, and are themselves divided into two classes:—

(*a*) Those whose energy is metered, that is, users of large boilers and of ovens working on heat accumulation, and

(*b*) Fixed-tariff consumers, that is, mainly domestic consumers having small water boilers.

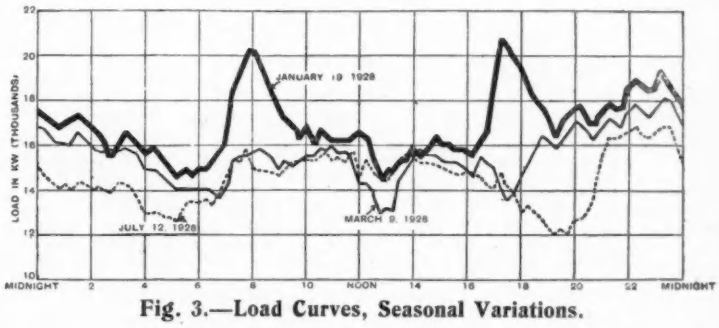


Fig. 3.—Load Curves, Seasonal Variations.

† Jahresberichte des Electrizitätswerks Basle, 1924-1927.

Table I on the previous page shows the numbers of these consumers from 1924 to 1927.

It is seen that, taking all consumers of heating energy as 100 per cent., there is approximately a 30 per cent. annual increase in the number of consumers of energy at the cheap rate, and that this annual increase is itself tending to increase. As pointed out above, this is despite the fact that the Basle undertaking has exploited this type of load since 1915. At the same time there is a healthy annual increase in the number of day consumers, though the latter represent rather less than one quarter of those consuming energy at night. Unfortunately, it is not possible from the yearly reports actually to see the kilowatt demand of each type of consumer, but from the extraordinary improvement in the overall load curve of the town (as shown in figs. 1 and 2), it is certain that the night energy consumption greatly predominates. It is, therefore, of more than passing interest to know that the revenue secured from the sale of energy for heating was last year more than one million Swiss francs, the figure in English currency being approximately £40,000.

(To be concluded.)

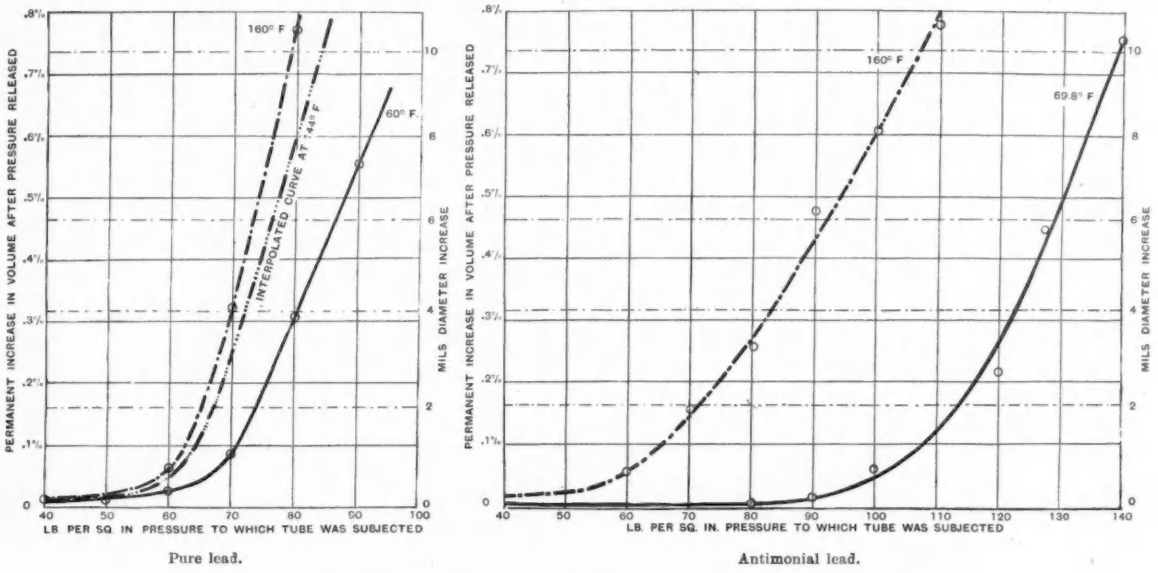
High-pressure Cables.

A reply to the suggestion that the alleged creation of voids in normal cables as a result of permanent distension of the lead sheaths lacks foundation.

By H. GURNEY WOOD.

In his recent article on the physical behaviour of lead sheaths in relation to failures of high-voltage cables,* Mr. C. J. Beaver, M.I.E.E., makes a number of points which must not be allowed to pass without comment.

The contention that the expansion of the impregnating compound sets up pressure inside the lead sheath is admitted, but it is argued that such pressure is not sufficient to cause permanent distortion of the lead. In this connection reference may be made to tests carried out by the Research Department of the Detroit Edison Co., when pressure was recorded as high as 85 lb. per square inch, with a corresponding vacuum of 15 inches.†


160° F
60° F.
INTERPOLATED CURVE AT 144° F
PERMANENT INCREASE IN VOLUME AFTER PRESSURE RELEASED
MILS DIAMETER INCREASE
LB. PER SQ. IN. PRESSURE TO WHICH TUBE WAS SUBJECTED
160° F
69.8° F
PERMANENT INCREASE IN VOLUME AFTER PRESSURE RELEASED
MILS DIAMETER INCREASE
LB. PER SQ. IN. PRESSURE TO WHICH TUBE WAS SUBJECTED

Pure lead. Antimonial lead.

Figs. 1 and 2.—Permanent Expansion of Lead Tube by Internal Air Pressure.

The pressure caused by the expansion of the compound will be limited by the ductility of the lead and by the air, or space, content in the cable. If the latter can be ascertained, it will be possible to predict what will happen in any given cable, provided the temperature distribution and the mechanical properties of the lead are known. Figs. 1 and 2 show the critical points in the cases of pure and hardened lead at two below a pressure of 40 lb. per sq. in. were rather irregular, probably due to the lead sheathing not being truly circular in section. Pressure was left on the tubes tested in every case for six hours before being released.

The relationship between the temperature and permanent increase in volume of a cable sample sealed at each end and heated to a uniform temperature is shown in fig. 3, and by comparison with the fig. 1 curve the probable internal pressures which produced the permanent expansion can be computed. If, for instance, the volumetric expansion of the lead was 0.05 per cent. at 115 deg. F., then the pressure in the closed

* Elec. Rev., January 18th, 1929, p. 96, *et sec.*

† *Nature*, March 3rd, 1928, p. 338.

sample must have been about 63 lb. per square inch. (absolute, 78 lb.). To check these results, lengths of cable were laid out on the bottom of a large concrete pit; the ends were properly sealed to prevent loss of compound and to enable loading currents to be applied, and tests were made to measure the power factor at high voltage. Pressure and vacuum gauges were inserted in the length of cable, so that the actual pressure inside the lead casing of the cable could be registered. Two typical curves are reproduced as figs. 4 and 5, with different current loadings: it will be noted that in both cases the pressure rises to a maximum, and then falls, which is typical of a large number of current runs on different cables.

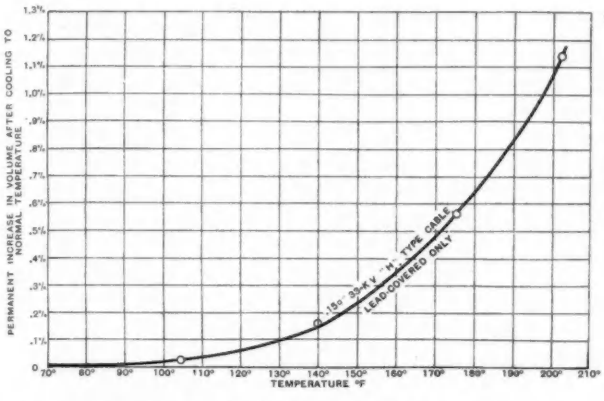

PERMANENT INCREASE IN VOLUME AFTER COOLING TO NORMAL TEMPERATURE
TEMPERATURE °F
0.15" 33-KV "H" TYPE CABLE
LEAD-COVERED ONLY

Fig. 3.—Permanent Expansion of Cable Sample by Heating for six hours to Temperature Shown and Cooling to Normal Temperature.

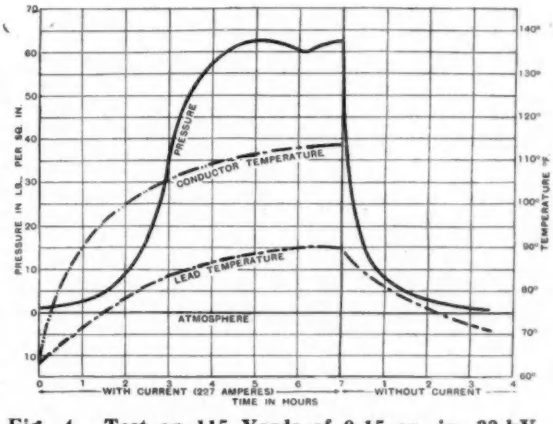


Fig. 4.—Test on 115 Yards of 0.15 sq. in. 33-kV Armoured " H "-type Cable.

The probable explanation is that the lead is slowly expanding under the internal pressure, as might be expected from the other curves shown. In the case of the first run at 290 amperes, the temperature of the conductors at the conclusion of the run was 162 deg. F., and that of the lead sheathing was 127 deg. F., which would result in an average compound temperature of about 144 deg. F. Reading on fig. 3 curve, the permanent expansion would be 0.16 per cent., which (from fig. 1 curve) would require an internal pressure of, say, 67 lb. per square inch. The pressure actually measured was 69 lb. per sq. in., and had been as high as 74 lb., the agreement between the results being very close. As has previously been stated, the pressure generated by the expansion of the compound is largely affected by the cushioning effect of the air space inside the cable. The larger the air space, the lower the pressure to which the cable will be subjected under a given temperature; whereas the more completely all air spaces are removed, the higher will be the pressure with an increase in the extension of the lead, and on cooling a higher vacuum.

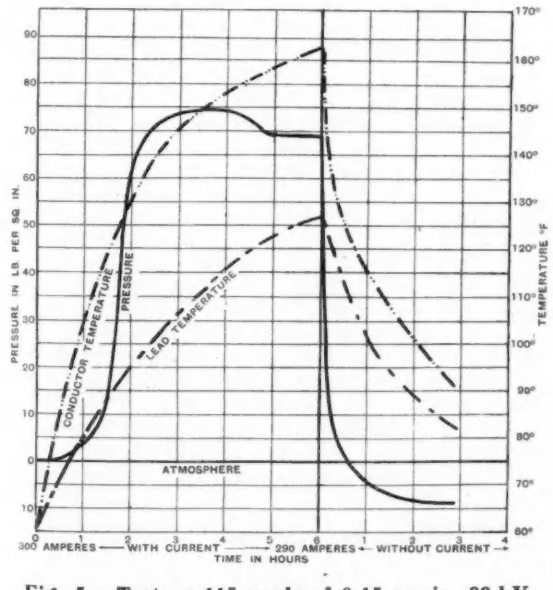


Fig. 5.—Test on 115 yards of 0.15 sq. in. 33-kV Armoured " H "-type Cable.

If the co-efficients of expansion given in Mr. Beaver's article are used as a basis of calculation, it will be found that the increase in volume of the dielectric in the prior-impregnated cable, due to a rise of 80 deg. F. throughout the whole cable, is greater than the increase of space inside the sheath due to the co-efficients of expansion of the lead by 0.021 cu. in. per inch length. This, by simple calculation, would indicate an air space figure of 0.064 cu. in., with the pressure recorded of 24 lb. (absolute). Applying the same constants to the vacuum-impregnated cable, the expansion to be provided for without stretching the lead is 0.0218 cu. in., which would indicate an air space of 0.0334 cu. in. at a pressure of 43 lb. (absolute).

The approximate space, or air content, in a cable may be directly measured by keeping a sample of the cable immersed in hot oil and collecting the air, or gas, which is driven off. The amount collected will not be the total quantity, but the method is a very satisfactory check on the impregnating process and the slackness, or otherwise, of the lead casing.

It is interesting to note that a cable made to the same dimensions as the vacuum-impregnated one mentioned by Mr. Beaver showed, by the method suggested for directly measuring the air space, a figure of 0.0328 cu. in. per inch. It would therefore appear that provided the air, or space, content is known and the correct figures for the co-efficients of expansion are used, it is possible to calculate what pressures are likely to be set up, and from the diagrams given to know if they are, or are not, likely to cause permanent expansion of the lead sheath.

The conclusions expressed in Mr. C. J. Beaver's article are seriously challenged by the curves reproduced herewith, as a pressure of 69 lb. per sq. in. is well above the critical point of ordinary lead in fig. 1, and that pressure was obtained with a conductor temperature of 113 deg. F.

The success and very general adoption of " H "-type cables is very good evidence that failures in the past have been due to the formation of voids, which, in a belted cable, are under electric stress; whereas, if they occur in an " H "-type cable, they are outside the field and therefore innocuous, and it is very well known that cable breakdowns are more likely to occur after the peak of the load has been passed, rather than when the temperature of the conductor is at its maximum.

The curves reproduced above are published by permission of Messrs. Siemens Bros. & Co., Ltd., Woolwich.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

An Improved Watertight Switch.

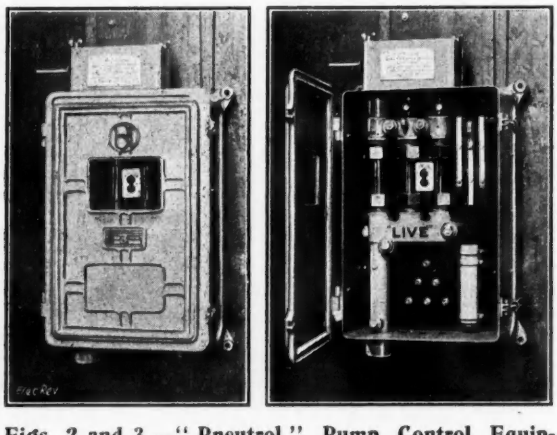
The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, has just brought out an improved design of the "Magnet" watertight quick-make and-break switch, fig. 1. Enclosed in a clean cast-iron case, this switch is operated by a solid brass pointer-type side handle. A boss on the inside of the operating lever enters a machined hole in the side of the casting and keys with a spindle connected to an inside

Fig. 1.—New "Magnet" Watertight Switch.

arm; these components are drawn together by a substantial screw through the gland, which is packed with tallowed hemp, thereby forming a well-lubricated watertight gland. The domed lid is fixed by two roundhead brass screws, and a good-quality rubber gasket is provided between the lid and box. Two fixing lugs are provided with countersunk holes, and a third lug is included, into which is fixed a large-sized brass round-headed screw with a washer for an earth connection. The convenient position of the conduit hole renders unnecessary any set or bend in the conduit.

Pump Control Equipment.

The "Pneutrol" control apparatus, figs. 2 and 3, is an ingenious device which has been introduced by Brookhirst Switchgear, Ltd., Northgate Works, Chester, to provide a sound engineering alternative to float switches or similar gear for use with automatic control panels for the the starting and stopping of electrically-driven pumps. The "Pneutrol" device can be mounted in a convenient position



Figs. 2 and 3.—"Pneutrol" Pump Control Equipment, "Closed" and "Open."

away from the tank, and the only part in contact with the liquid to be pumped is a small vertical compression tube which is connected to the control equipment by means of a plain ¼-in. copper pipe. Variation in level of the liquid causes a variation of pressure in the pipe, and this imparts movement to two columns of mercury within the "Pneutrol" equipment. The operating circuit of the control panel is made or broken, according to the level of the mercury in the control apparatus, at points independently adjustable in each column.

The principal advantages claimed for the new control equipment are: there are no external moving parts in contact with the liquid, and cumbersome float gear is avoided; it is not necessary to place the device in proximity to the tank, where the atmospheric conditions may be unsuitable, and it can be situated in a convenient position under cover; as the make and break contacts are enclosed in glass tubes they are unaffected by external conditions; the starting and stopping limits are not affected by rolling or surging of the liquid in the tank or sump; for marine installations, the "Pneutrol" control has the further advantage that it acts definitely and with reliability under any conditions of weather experienced by a ship at sea.

A New Searchlight.

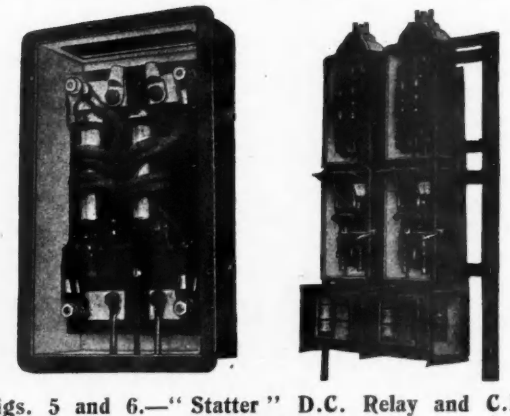
Fig. 4 shows a searchlight which has been produced by the London Electric Firm, Brighton Road, South Croydon, for the Royal National Lifeboat Association, forming part of the equipment of the recently-launched new super motor lifeboat delivered to Cromer. It is made in very light non-corrodible metal, but perhaps the most important feature is that it is entirely watertight. There is an inlet gland for the cable and another gland for the spindle of the lamp focus gear; the

Fig. 4.—A L.E.F. Lifeboat Searchlight.

latter can be operated without removing the hand from the handle, so that the searchlight may even be worked under the water. It is made for low-voltage lamps taking up to 60 W, the gasfilled variety being usually employed.

D.C. Leakage Relays.

To afford a ready means of complying with Regulation 94 F of the Wiring Rules of the Institution of Electrical Engineers, which requires that "in installations in which the normal working current in any circuit or circuits connected to the



Figs. 5 and 6.—"Statter" D.C. Relay and C.B. Combination.

main distribution board exceeds 100 A, there shall be provided, in addition to a fuse or circuit breaker with overload trip, an automatic device whereby the installation or faulty circuit, as the case may be, shall be disconnected in the event of a leakage to earth," Messrs. J. G. Statter & Co., Queen Anne's Chambers, Westminster, S.W.1, have introduced a range of d.c. relays. These are enclosed in c.i. cases with machined flanges, each being provided with inlets and outlets convenient for passing the full current of the circuit to be protected

by it. The relays are wound for various current ranges, but all ranges are calibrated at from 50 to 100 A; in other words, they may be set to trip out at any current leak of from 50 to 100 A. Fig. 5 shows the standard relay with its cover removed. In operation the relay closes a pair of contacts, thereby energising a pressure trip coil on the circuit breaker. The contacts are not intended to break the circuit of the pressure trip coil; an auxiliary switch should be fitted in the breaker for this purpose. Alternatively the relay may be connected on the dead side, so that when the main circuit breaker opens the pressure trip coil is dead. Fig. 6 shows an equipment consisting of 2 d.p. circuit breakers and two relays, protecting two circuits against overload or leakage. The position of the bus-bar chamber and bars below the units is optional. Frequently the bus-bars are at the top, then the d.p. circuit breakers and the relays and outlets are at the bottom.

The relays are supplied in five sizes for carrying normal currents of 100, 200, 400, 600 and 800 A, respectively. The size of the smallest relay is 24 in. by 14 in. by 8 in., and of the largest relay 28 in. by 20 in. by 9 in.

The Brisbane Bulimba Station.

Particulars of the New Electricity Works of the City Electric Light Co., Ltd.

By JOHN S. JUST, M.I.E.E.

(Abstract of a Paper read before the BRISBANE DIVISION *of the* INSTITUTION OF ENGINEERS, AUSTRALIA.)

THE following are some notes in connection with the generating station of the City Electric Light Co., Ltd., at Bulimba, Brisbane, which I have had the honour of designing, constructing, and operating. The City Electric Light Co., Ltd., was exceedingly fortunate in finding a site within a radius of six miles of the General Post Office, Brisbane,

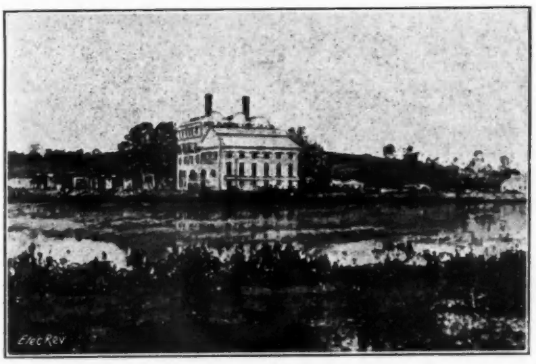


Fig. 1.—The Bulimba Generating Station.

which, from points of view of railway facilities, circulating water and transmission-line routes, is essentially able to economically support a station of well over 500,000 kW output capacity.

The layout of the Bulimba station, figs. 1 and 2, is such that the boiler room is at right angles to the engine room. The turbine room and boiler room extensions are towards the inlet water canal, with room for an additional switchgear bay between the canal and the boundary road. Coal is brought to the rear of the building and dropped by gravity into a 30-ton receiving hopper, and thence elevated by bucket conveyors to the overhead bunkers.

The boiler room has been arranged for four boiler units, three to have an evaporation of between 100,000 and 125,000 lb. of feed water at 90 deg. F. to steam at 300 lb. per sq. in., 750 deg. F., and a fourth with a maximum evaporation of 150,000 lb. per hour. The boilers are erected on steel framework carried from the ash pit floor; three are by Messrs. Babcock & Wilcox, Ltd., and one by Messrs. John Thompson Water Tube Boilers, Ltd.

Provision is made for two evaporations, each capable of dealing with the total water required under normal conditions by the boiler plant. Owing to the high-temperature steam conditions very large area condensers are installed, and as a condensing medium the feed water is used, so that the output of the evaporation is largely governed by the loading on the boiler at a given time. If extra treated water is required the evaporation may be worked to the total output by passing the treated water into the working condenser in the engine room. In addition to the evaporators chemical treatment plant, together with a filter bed, is provided. The ash-removal method adopted is through a water seal by drag chains.

Two drag-chain conveyors are provided, and the ashes are taken to various dumps by a light 2-ft. gauge tramway.

A 60-ton 4-motion electric travelling crane spans the engine room, in which is installed a Fraser & Chalmers turbine of 12,500 kW economic rating, 3,000 r.p.m., eight-stage impulse, single flow, from which steam is bled for feed heating, coupled to a 5,600-volt, three-phase alternator of 15,000-kW capacity, manufactured by the General Electric Co., Ltd. The condenser, which is fixed immediately below the turbine, is of the Allen two-pass, "Contraflo" type, containing 20,700 square feet of cooling surface, and capable of condensing 148,000 lb. of steam at 28-in. vacuum when supplied with 1,040,000 gallons per hour of cooling water at 80 deg. F. A Parsons turbine represents a departure in that it is a pure reaction set, which thus increases its overall length to 42 feet. It has similar output and other details to the General Electric turbine, and is coupled to a Parsons alternator. Owing to the low-temperature rise of the alternators they are usually rated for continuous service at 20,000 kVA.

A third set, of 15,000 kW, to be installed will be moved from William Street; it was manufactured by the Metropolitan-Vickers Electrical Co., Ltd.

Generally the switchgear is designed to couple the alternators directly to the bus-bars, through transformers, and thence to the feeders. The system is laid out for a rupturing capacity of 500,000 kVA. There are ten 5-kV to 33-kV step-up transformers—33 kV, 400 A—and o.c. breakers, lightning arrestors, disconnecting links and choke coils controlling four 33-kV overhead feeders and two 33-kV underground feeders.

All the switchgear is of the outdoor type, and, where necessary, is supported on framework. The electrical auxiliary units in the power house can be fed either from the corresponding machines themselves, making self-contained units, from common busbars, or from any of the turbines.

There are at present two aerial lines, each of three conductors of 19/12 stranded copper, erected on a single line of poles. A new double-circuit line of similar size is under construction; this line will cross the Brisbane River at New Farm by means of flexible steel lines approximately 250 feet

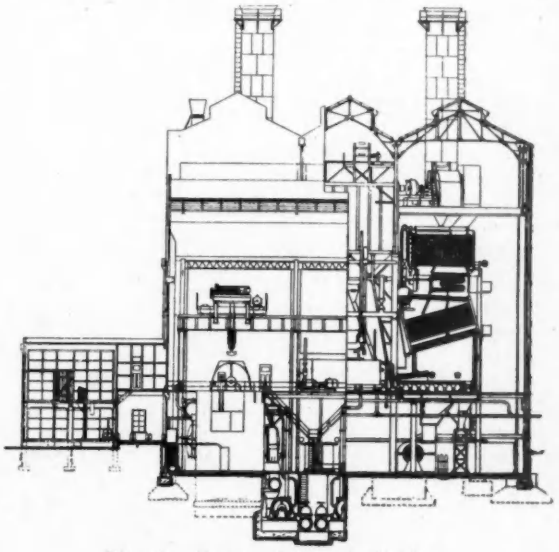


Fig. 2.—Section Through Station.

high. The aerial conductors are mounted on ironbark poles and wooden crossarms, and are spaced 36 inches apart.

The step-down sub-stations are similar to the step-up ones, and house 5,000-kVA, 33—5 kV transformers, controlled by 33-kV, 3,000-A, oil circuit breakers and disconnecting links.

The Electricity Commissioners' Work.

Brief Extracts from their Eighth Annual Report, for 1927-28.

THE eighth annual Report of the Electricity Commissioners,* covering the period April 1st, 1927, to March 31st, 1928, contains prefatory observations on the regional schemes adopted by the Central Electricity Board, and a brief review of some aspects of rural supplies of electricity and the overhead-line wayleave situation.

Undertakers and Areas.

Inclusive of the C.E. Board and allowing for two companies with undertakings in England and also in Scotland, the number of separate undertakers was 642, a net addition of 19, consisting of 376 local authorities, 261 companies and persons, four Joint Boards, and two J.E.A.'s.

The authorised distribution areas embraced over 92 per cent. of the cities and boroughs, 86 per cent. of the urban districts and 58 per cent. of the parishes in the rural districts in England and Wales; and about 68 per cent of the cities and burghs and 29 per cent. of the civil parishes (exclusive of burghs) in Scotland. The authorised distribution areas in Great Britain covered about 89 per cent. of the urban areas containing upwards of 97 per cent. of the urban population; and nearly 42 per cent. of the rural areas containing upwards of 67 per cent. of the rural population. It is clear that the majority of the areas possessing the higher average densities of population, and thus presenting the better prospects of development on a remunerative basis, have already become occupied. The unoccupied areas in which no supply of electricity has yet been authorised, consist mainly of the more sparsely populated rural portions of the country, amounting to 45 per cent. of the total area, but containing only 5 per cent. of the total population, with the low average density of 56 persons per square mile. The rural areas for which powers have been granted since 1920 account for upwards of 82 per cent. of the area, and about 69 per cent. of the population of the rural distribution areas existing at March 31st, 1928. The figures also reveal the increasing sparseness of the rural areas for which supply powers have been sought in recent years, the average density of population in the rural areas of supply authorised prior to 1920 being of the order of 332 persons per square mile, as compared with 156 persons per square mile in the case of the rural areas of supply authorised subsequently.

Generation and Consumption.

The energy generated by the total of 570 stations amounted to 9,927,850,630 kWh, the fuel consumed being 9,034,823 tons of coal, 149,721 tons of coke breeze, and 40,107 tons of fuel oil. The 486 authorised undertakers' stations generated 8,551,425,279 kWh. Thus the output increased by nearly 18.7 per cent., for an increase of only 5.4 per cent. in the amount of coal and coke consumed, and accompanied by a falling off in the use of oil fuel, *i.e.*, 40,107 tons, as compared with 145,911 tons in 1926-27. It should be noted that the production of electricity at the stations included within the scope of the returns has practically doubled since 1920-21; also that there has been an all round increase of the order of 54 per cent. in the amount produced per ton of coal and coke consumed, compared with technical practice in 1920-21.

The number of stations remained the same as in the previous year, the closing down of 23 during the year being offset by the coming into operation of the same number of other stations, which included the new stations of the Corporations of Carlisle and Colchester, the Ferrybridge station of the Yorkshire Electric Power Co., and the hydro-electric stations of the Lanarkshire Hydro-Electric Power Co. at Bonnington and Stonebyres. Of the 570 stations, 251 (44 per cent.) generated less than 1,000,000 kWh each during the year, while 400 stations (70.2 per cent.) generated less than 10,000,000 kWh each. The remaining 170 with individual outputs of 10,000,000, or over, were collectively responsible for as much as 93.6 per cent. of the total generated.

The energy sold in 1927 increased by 1,126,509,285 kWh to a total of 6,850,162,808 kWh. Companies sold 2,519,521,676 kWh, an increase of 492,673,291 kWh, while the local authorities' increase was 639,835,994 kWh.

There was an increase of about 19.6 per cent. in the sale of electricity by authorised undertakers, as compared with 1926, and a total increase of about 88 per cent. during the five years since 1922. On the basis of the estimated total population of Great Britain at the end of 1927, namely, 44.18 million, the sale of electricity from public sources of supply in that year thus represented an average consumption of 155 kWh per head of population, but large additional supplies used in manufacturing and trading operations are derived from privately-owned plant, which has been installed on a widespread scale and does not come within the scope of the statistical returns. A valuable indication of the extent of the plant installed in factories and other works is contained in an appendix to the present report, which shows that the industrial generating plant installed in 1924 amounted to about 2,564,000 kW, as compared with 3,943,000 kW in the case of authorised and non-statutory electricity undertakings supplying mainly for sale to the public. The generating resources of trade and industry in that year thus represented an addition of about 65 per cent. to the resources of electricity supply undertakings.

* H.M. Stationery Office, price 3s. net.

Electricity Districts.

As in previous years, action taken relative to Electricity Districts was mainly confined to matters arising from the various district orders already in force, but the Commissioners proceeded with the formulation of a scheme for the North-West Midlands Electricity District, and the establishment of a Joint Authority is based in respect of technical development upon the transfer to the Joint Authority, when established, of the generating stations of the Corporations of Stoke-on-Trent and Stafford, and upon the construction by the Joint Authority of a secondary transmission system in the district which would supplement the main transmission system of the regional scheme for central England.

New Generating Stations.

The aggregate capacity of the generating plant for new stations and that for extending existing stations sanctioned by the Commissioners during 1927-28, amounted to 668,357 kW; while the amount of plant sanctioned for new generating stations was greater than in the previous year, the amount sanctioned for the extension of existing stations was smaller by about 118,000 kW. Of the generating plant sanctioned during eight years, approximately 57.9 per cent. was for local authority undertakers; about 34.5 per cent. for company undertakers; and about 7.6 per cent. for stations owned by railway and tramway authorities and non-statutory undertakings; in a number of instances the installation of the new plant involved the displacement of other equipment of an obsolete type. During the year ending March 31st, 1928, the Commissioners issued fifteen consents (nine to authorised undertakers and six to non-statutory undertakings) in respect of the establishment of new generating stations, representing the initial installation of plant of a total rated capacity of 246,642 kW. The three principal consents authorised the erection of new stations with initial capacities of 50,000 kW, or over, by the London Power Co. (Battersea), Leeds Corporation (Kirkstall), and the Lancashire Electric Power Co. (Kearsley). Applications from the London and Home Counties J.E.A. (Chiswick, since abandoned), West Midlands J.E.A. (Ironbridge, now being constructed), and the North Wales Power Co., Ltd. (Maentwrog, hydro-electric, now in operation) were under consideration and the ten following stations were being built: County of London E.S. Co., Ltd. (Barking, second half), North Metropolitan Power Station Co., Ltd., (Brimsdown, in operation), Oldham Corporation (Chadderton), Yorkshire Electric Power Co. (Ferrybridge), Birmingham Corporation (Hams Hall), Lancashire Electric Power Co. (Kearsley), Leeds Corporation (Kirkstall), Lochaber Power Co. (hydro-electric), Coventry Corporation (Longford, now in operation), Bristol Corporation (Portishead). The Commissioners prescribed the type of current, frequency, and pressure to be used at the three new private generating stations established by the Consett Iron Co., Ltd. (Derwenthaugh), Hollis Bros. and Co., Ltd. (Hull), and the Royal Leamington Spa Corporation (Warwick sewage works).

Extension of Stations.

During the year consents to the extension of existing generating stations were given by the Commissioners to sixty-one authorised undertakers, and in eleven further cases to railway and tramway authorities and non-statutory undertakings, representing, in aggregate, a plant capacity of 421,715 kW: the division of the total was as follows:—Local authority undertakers, 237,480 kW; company undertakers, 143,811 kW; railway and tramway authorities, 40,000 kW; and non-statutory undertakings, 424 kW. Consents authorising the installation of 10,000 kW, or more, were issued to sixteen authorised undertakers and two railway authorities, accounting for 323,000 kW, or approximately 76 per cent. of the above-mentioned aggregate. In six instances sanctions were given to the installation of 25,000-kW sets, namely, in the Deptford station of the London Electric Supply Corporation, Ltd.; the Spondon station of the Derbyshire and Nottinghamshire Electric Power Co.; the Dalmarnock station of Glasgow Corporation; the Willesden station of the London Power Co.; the Blackburn Meadows station of Sheffield Corporation; and the Freeman's Meadow station of Leicester Corporation. In

the case of two applications for consent to extend existing stations, made by the Metropolitan Borough Council of Southwark and the Corporation of Darwen. the Commissioners found it necessary, after local inquiries had been held, to refuse their consent as a case for extended local generation, as compared with the alternative of a bulk supply, had not been proved to their satisfaction.

Main Transmission Lines.

Apart from the applications to the Commissioners during the year under review of the Central Electricity Board for consent to the establishment of 132,000-V overhead transmission systems, formal consents were issued in repsect of sixty-four applications. In eighteen cases they related to 33,000-V transmission lines, and in two instances they covered the establishment of 66,000-V transmission lines, namely, by the Shropshire, Worcestershire and Staffordshire Electric Power Co. and the North Wales Power Co., Ltd., respectively. The consent issued to the latter company was of a comprehensive character, covering twenty-six sections of the main transmission system ranging from 6,600 to 66,000 V.

Special Orders.

At the commencement of the year ninety-five applications for special orders relating to the establishment, or extension, of distribution undertakings, &c., were under consideration. During the year eighty further applications were received and one of the applications previously made was divided by the Commissioners into two parts, thus making a total of 176 applications under consideration. During the year the Commissioners made special orders in respect of eighty-one of the applications before them, all of which had been submitted to the Minister of Transport for confirmation by March 31st, 1928. Of the other applications, four were refused and ten were withdrawn, while in the case of an application made by a statutory gas company, the Commissioners were unwilling to make an order and referred the application to the Minister of Transport. The eighty remaining applications were under consideration at the end of the year.

Of the eighty applications received during the year, thirty-nine related to the establishment of new distribution undertakings and thirty-six to the extension of existing areas of supply; as in previous years, a noteworthy feature of many of the applications was the large extent of the proposed areas of supply. There was again a pronounced element of competition between applications, as many as twenty-four of the applications lodged during the year competing, as regards the whole, or a portion, of the proposed area of supply, with current or prior applications. In the course of the year ten inquiries, affecting seventeen applications, were held by the Commissioners and parties concerned in other cases were also heard.

(To be continued.)

D.C. Cable-Testing Equipment.

Some of the general principles and theoretical considerations involved in the use of a high-voltage thermionic a.c. rectification outfit.

AT a recent meeting of the London local technical group of the Electrical Power Engineers' Association, held in the rooms of the Junior Institution of Engineers, Mr. H. B. Gough, discussed the general principles and theoretical considerations involved in the high-voltage d.c. testing of cables with the aid of thermionic valves, the design and construction of testing equipment, and procedure when testing. Testing sets were usually designed to meet the specific requirements of the individual user, and a complete outfit was possibly more useful and time-saving when actually on site, as few connections had to be made; but, from the point of view of portability, it was of advantage to divide the set up into a number of small parts, each of which being reasonably portable. He illustrated a typical set of this character.*

If the cable was perfectly sound and the leakage current infinitesimal, the most simple means of voltage measurement was by the use of an electrostatic voltmeter connected directly across the cable under test, as the percentage ripple on the cable was practically nil. When the leakage current was of considerable value, however, as it might be on an overhead line in foggy weather, voltage measurement by that means should be viewed with suspicion, as the peak voltage was greater than the r.m.s. value. Under such circumstances it was advisable to use a sphere-gap voltmeter, which might be set at the required test pressure and the voltage gradually increased by means of the primary controls of the testing equipment until sparking over the sphere gap took place; a sphere-gap voltmeter should not be used without a limiting series resistance. The reading of the primary voltmeter and the electrostatic voltmeter should be noted at the moment of spark-over: the sphere-gap might then be opened, say, 10 per cent. more than for the required test pressure, and the test carried out in accordance with the previously noted readings of the electrostatic and primary voltmeters. Incidentally, the primary voltmeter reading gave a very accurate indication of the secondary voltage, which might be calculated from the formula: $E = \sqrt{N}e$, where E = test voltage, e = primary volts, and N = transformer ratio. The result obtained was for a single-valve test; when using equipment for a two-valve test, the figure obtained by the formula must be doubled.

In designing transformers for cable-testing equipment the experience gained in X-ray work had been of the greatest value, the conditions being somewhat similar for both classes of work. The secondary winding of small transformers for voltages up to 60 kV was of the single-section layer type, graded and spaced to provide mechanical stability and electrical strength. For regulating the testing output voltage a regulator was connected in the primary circuit of the step-up transformer. Perhaps the simplest method was to use a shunt rheostat. As a means of control for small sets used for pressure testing only, a potentiometer was suitable, as the voltage output might be varied evenly from zero to the maximum. For fault burning and locating when large currents were required, the size and cost of a suitable rheostat became prohibitive, and another method must be adopted; an induction regulator was suitable under certain conditions, and had been used in connection with cable-testing equipment, but the size and weight were out of proportion to those of the rest of the apparatus; also, it was expensive, and in the event of a breakdown of the cable under test it did not limit the amount of current flowing through the equipment, unless an additional choking coil was connected in series. The most suitable method of control was by means of a combination of a tapped auto-transformer and variable choke coil: the voltage on the cable under test might be raised by means of the auto-transformer until the test pressure was almost reached, the final adjustment being made by the variable choke coil. The advantages of that system were simplicity, low first cost, and the inclusion in the primary circuit of a large choke coil which, in the event of a fault occurring suddenly, acted as a current limiter and saved the component parts of the equipment (especially the valves) from being overloaded.

It was inadvisable to discharge a cable by direct connection to earth, although one engineer had adopted that method, so far without harm. It was a harsh method, and in the opinion of many engineers it was liable to cause breakdown of the cable, due to the surges set up. Therefore, it was advisable to include high resistance in the discharge circuit: a simple method was to fill a rubber tube with water, connect one end of it to earth, and attach the other terminal to the cable. Wire-wound resistance was unsuitable, owing to breakdown between individual turns, but a method which had given satisfaction was to discharge through a wooden resistance; the equipment was rather cumbersome, however, and seemed to be unnecessary. The most successful method was by the use of water-moistened cotton tape, which had the advantage of cheapness and portability, and discharged the cable quickly and safely. To nearly every testing equipment was fitted a bank of resistances, usually "Silit" (a type of carborundum) rods, and if the resistance value of the bank was great enough the cable might safely be discharged through it. After being discharged, all the cores must be solidly earthed for some hours; if that was not done, a potential would build up again on the cable, due to the "soakage" effect of the insulation, sufficient to give an unwary worker a severe shock if the cable were touched.

High resistance (usually of the order of 5 ohm per volt) must be included in the circuit with the valves and cable under test (water wire-wound, or a bank of "Silit" rods) to protect the valves against surges and help to limit the current which would flow in the event of a fault taking place. When testing overhead lines it often happened that high-frequency oscillations found their way back into the set through the capacity of the valves, and to prevent damage to any of the primary circuits it was advisable to place between the primary and secondary windings of all transformers metal shields solidly connected to earth.

Should a fault occur on the line during test, it would be indicated by a sudden increase of leakage current, accompanied by a corresponding fall of voltage across the cable. If a fault was of the "self-sealing" variety, after the pressure reached a certain value a heavy current would flow suddenly, the

* ELEC. REV., February 15th, 1929, p. 307.

pressure falling away; gradually the pressure would rise again, the current decreasing until the whole cycle of operations was repeated. When that occurred, pressure should be kept on the cable, and as a rule the frequency of the charge and discharge became more and more rapid, until finally a steady value of current was obtained. The fault should be located at once, and a special point was that there should be no delay between switching off, connecting the fault-locating bridge in circuit, and proceeding with the localising.

Direct pressures up to 200,000 volts could be obtained by means of the two-valve arrangement, but to obtain pressures greater than that it was necessary to use condensers and join two circuits in series.

Discussion in London.

Mr. Allen, who presided, suggested that the wooden discharge device was simpler than moistened cotton tape, and that it was not necessarily cumbersome. Within 1 or 1½ minutes the discharge was effected quite sweetly, and there was no question of surges occurring. He was particularly interested to note how accurately it was possible to localise faults; he had got to within 0.2 per cent. of the correct position, which he regarded as an excellent result. He agreed with a suggestion made by Mr. Gough, that the osmosis effect caused a d.c. test to be very much more severe, relatively, than theoretical people would have them believe.

Major A. M. Taylor noticed that in diagrams exhibited by Mr. Gough the three cores were shown bunched together: presumably that was practicable with his form of test, but it would hardly be practicable with the power-factor form of test. About 72 drum lengths totalled 9½ miles of 33-kV cable, and, presumably, when a cable went wrong the trouble was just as likely to be due to one particular drum length having been wrongly impregnated, or to possess some other fault, as to anything else. If a particular drum length doubled its power factor, could one detect that in 9½ miles of cable with Mr. Gough's method of testing? That was rather a tall order, but he believed one could do it with the power-factor test. One did not wish to break down the cable at once, but to ascertain if there had been any diminution since it was laid; one wanted to keep a regular month-by-month record. In that sort of test obviously one wanted considerable accuracy, because 1 in 72 was only 1½ per cent., and if there were a departure of 1½ per cent. from the original test leakage one wanted to detect it and to know whether, under those conditions, it was possible to detect it without going any further in the way of breaking down the cable. In the case of six trunk cables in Birmingham, 18 cores would have to be tested, and one had to consider very seriously how to work them in and out, because 60,000 kW would be transmitted, and they would probably be working for all they were worth during the whole of the 24 hours of each day under the Government scheme; one had to consider when they could be out of commission for testing, and the time occupied by the test was, therefore, important. He gathered that the sets described by Mr. Gough would be expensive, but he did not suppose power-factor testing apparatus was very cheap.

Mr. F. Charles Raphael asked if the osmotic effect would become evident, assuming there was moisture in the cable, during a quarter-of-an-hour's test. Mr. Gough's fault-locating results were extremely accurate. In ordinary testing with d.c. batteries, or whatever was used, and with an ordinary slide-wire resistance and galvanometer, there was no difficulty in achieving accuracy within 0.1 per cent. of the total length of the cable; it was wrong to calculate it as a percentage of the distance of the fault. What would happen to the step-down transformer for heating the filament if the cable broke down during a test? Should a high voltage surge take place in the secondary winding, the latter would act as a primary and the voltage would be stepped up in the real primary. Did Mr. Gough rely simply upon the series resistance, or was there any other method of protecting the transformer?

Major Taylor said he was anxious to find a method of ascertaining what change might occur in the condition of a cable during a period of, say, a year, and he asked whether a test applied a year after the installation of a cable could be relied upon to show the same voltage, within a fraction of 1 per cent.

Mr. Fernie regarded the method of fault location described as being rather "chancy." He did not think that as the result of using that method one could scrape one's foot on the ground at a particular spot and say with certainty that the fault was there. One could do that with confidence only when using a search coil and a telephone, so far as he knew. He asked if Mr. Gough's d.c. apparatus could be adapted for finding faults in that way, and whether it would be practicable to include in the circuit some kind of interrupter to make and break the current.

Mr. Hilling gathered that when testing by the two-valve method between two cores, one would be positive and the other negative. If that were so, would the osmotic effect be neutralised?

The Author, in reply, remarked that factors of inaccuracy to be looked for included the human element; the necessity for making quite sure that one obtained a dead balance, by observation, of the galvanometer; and also it was advisable to check the bridge against a very accurate Wheatstone bridge. The County of London Co.'s engineers had a very accurate Wheatstone bridge, and occasionally checked their fault-locating bridge against it, but generally the latter was found to be sufficiently accurate to enable one to find a fault. Major Taylor could carry out definite period tests with d.c. testing equipment, whereby he could reproduce exactly the original voltage; that type of test had never caught on in this country, but in Holland, particularly, he believed the majority of power engineers tested all their cables at definite intervals of time to measure the leakage current; if there were a rising characteristic they immediately suspected an incipient fault. Fault-locating on long lengths of cable by the County of London Co. was fairly accurate.

The examples of fault locating to which he had referred were actual tests, and they indicated a very high degree of accuracy. One might not be able to locate the exact point of a fault, but could get to within a very few yards of it; the natural thing to do then was to examine the nearest joint. The interrupted d.c. method mentioned by Mr. Fernie would not be very successful. Osmosis did occur in a cable. Some engineers, who realised that, adopted the practice of carrying out half the test one way round and then reversing the connections and testing the other way round for the other half of the period of the test. The method of testing back from the other end of the line when locating faults, as suggested by Mr. Watson, had been tried, and a greater degree of accuracy could be obtained thereby.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

American Control of Electricity Companies.

On February 18th Mr. Wellock asked the Minister of Transport if he was aware that an American utility company had acquired through the Greater London and Counties Trust, Ltd., the control of seven British power companies and substantial interests in others, all of which enjoyed a statutory monopoly; and if the Government would consider whether, and in what ways, this step might affect British interests.

Colonel Ashley said he had seen statements in the Press to the effect mentioned in the first part of the question. With regard to the general question raised in the second part, he did not think that he could usefully say more than that it had engaged his attention.

Electrical Explosions.

On February 19th Mr. Hore-Belisha asked the Minister of Transport if he would state whether attention had been given to the annual reports for 1925 and 1927, of Dr. Waldo, Coroner for London, with regard to electrical explosions and fire prevention; and what steps were being taken in support of his recommendations that the existing regulations for securing the safety of the public and for ensuring a proper and sufficient supply of electrical energy should be revised.

Colonel Ashley said he was informed by the Electricity Commissioners that attention had been given to the reports referred to, and that they were at present engaged upon the revision of the regulations referred to.

Electricity in Rural Areas.

On February 21st Rear-Admiral Sueter asked the Minister of Transport whether, in view of the information contained in the eighth annual report of the Electricity Commissioners, recently issued, any steps could be taken to speed up the supply of cheap electricity to rural areas; if he would state when he anticipated electricity would be available to rural areas within a 50-mile radius of London; and whether he had a representative of his Department who had the sole duty of pressing forward the development of electricity for rural areas.

Colonel Ashley replied that the general question had engaged his special attention, and, so far as his Department and the Electricity Commissioners were concerned, all possible steps would continue to be taken to expedite the supply of electricity to rural areas. Much expansion had occurred in the last two or three years. As regarded the London area, the whole of it, with the exception of a few parishes in the south, was either already covered by statutory powers for the supply of electricity or by applications which were now before the Commissioners for such powers. He would expect that electricity would be available throughout this district within the next three or four years. The answer to the last part of the question was in the negative.

Ratable Value of P.O. Wires.

On February 21st Mr. Hurd asked the Secretary to the Treasury whether, as a promise was made by the Treasury to the Central Valuation Committee that the ratable position of Post Office overhead and underground wires and cables should be investigated, he would say what was being done in the matter; and whether meanwhile the assessments of other electrical properties were being raised under the Act of 1926.

Mr. A. M. Samuel said that this matter had been carefully considered. The Central Valuation Committee had been in-

formed that the Government was not prepared to alter the existing arrangements as regarded Post Office wires and cables. He had no information as to the assessment of other electrical properties.

The Inland Telegraph Service.

On February 21st Commander BELLAIRS asked the Postmaster-General, in view of the loss of £1,300,000 or more per annum on the inland telegraphs, whether he was aware that the Hardman-Lever Committee of 1927 was not permitted to consider the aspect of transfer to private enterprise; and whether, as the situation had been changed by recent legislation transferring the external cables to the new Communications Company, the Government would open negotiations on similar lines with that company with regard to the remaining telegraphs.

Mr. F. G. PENNY, who replied, said that the circumstances under which certain overseas services were to be transferred to a Communications Company had no analogy in the case of the inland service; and the reply to the latter part of the question was in the negative.

The Co-ordination of Communications.

Commander BELLAIRS also asked the Postmaster-General whether he was aware that, in Section 66 of the Hardman-Lever Report of 1927, the Committee unanimously advised that the possibility of the complete fusion of the telegraph, cable, wireless, and telephone services might with advantage be explored; and whether it was the intention of the Government to obtain the evidence of officials of American companies.

Mr. F. G. PENNY said that the answer to the first part of the question was in the affirmative, and to the second part in the negative.

Lancashire Electric Power Co. Bill.

On February 20th, the Unopposed Bills Committee of the House of Lords passed this Bill, which empowers the company to raise additional capital to the extent of £1,000,000 and to increase the borrowing powers from one-third to one-half of the issued capital.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

E.D.A. Activities.

The latest production of the British Electrical Development Association is a coloured poster (E.D.A. 761) in connection with the spring-cleaning campaign. It measures about 19 in. by 28 in., and depicts a little girl operating a vacuum cleaner. It is really an anti-spring-cleaning poster, for it announces that "Electricity Cuts Out Spring Cleaning." The Association announces that the principal speaker at the annual dinner on March 14th (Piccadilly Hotel) will be the Earl of Birkenhead.

The F.B.I. and Industrial Conferences.

The Federation of British Industries and the National Confederation of Employers' Organisations have addressed a joint letter to the General Secretary of the General Council of the Trades Union Congress, stating that they would welcome an opportunity of a conference with the General Council at which they could examine the question of consultation together upon matters of common interest to British industry. At this conference they could explain the difficulties which stand in the way of consultation through a National Industrial Council as proposed in the "Melchett-Turner" Report, which the two bodies are unable to accept. They are conscious of the importance of doing everything in their power to further the promotion of industrial peace in British industry, and the invitation is made in the hope that the discussions will be such as to help forward a better mutual understanding in industry generally.

Commercial Electrical Travellers.

The annual dinner of the Electrical Trades' Commercial Travellers' Association was held at the Connaught Rooms, Great Queen Street, W.C., on February 22nd, Mr. Arthur Chamberlain, J.P., presiding. Following the loyal toast, Mr. Chamberlain, in thanking the Association for electing him as its president, said that there was a common bond between him and the Association as he was a manufacturer. As chairman of a number of electrical manufacturing companies he sidered that good commercial travellers were pearls beyond considered that good commercial travellers were pearls beyond price. Another bond with the Association was that he also was a commercial traveller, and he briefly outlined the many products in which he had travelled. Referring to the art of salesmanship, he recommended that travellers should take up a course in the science of salesmanship, and suggested that the Association might engage a professor of the science of selling to give a series of lessons. He congratulated the Association on its continued growth, and commended it to travellers not already associated with it as a means of increasing their efficiency. In proposing the Association and its charities, Mr. H. Wynne Roberts suggested that the members should also become members of the Electrical Development Association. He was of opinion, from the disappointing discussions at the salesmanship conferences of the latter association, that the conferences had not achieved their aim and that they should take the form of schools instead. Their Association was not yet representative of the electrical industry, and it could increase its usefulness by opening branches in provincial towns such as Birmingham. In responding, Mr. J. W. Ward, chairman, said that in connection with the opening of branches in the provinces, the Association had received a proposal from a traveller to form a branch in Nelson, and it had promised him its support. He agreed that they still had a lot to learn and should acquire sufficient technical knowledge of the products they were endeavouring to sell. A Development Committee had been set up to consider this problem, and a scheme would be ready in due course. The toast of the Press was proposed by Mr. F. H. Page, and Mr. Keir suitably responded. An appeal made by Mr. W. T. Rushton for the Association's charities realised £8 18s.

The German Glow Lamp Trade.

A favourable development in the German foreign trade in glow lamps is reported to have taken place in the past two years. Since 1926 the number of metal filament lamps exported has risen from 20 millions to 69 millions, and the export value has increased from nearly 14 million marks to 54 million marks. At the same time a decline in foreign competition in the German inland market has been noticed; the imports of metal filament lamps, which advanced by 2½ millions in 1927 to 6.25 millions, declined to 5¼ millions in 1928. The imports are almost entirely from Hungary and Austria, and only 242,000 lamps were received from Holland last year.

Suggested Overseas Advertising Fund.

Mr. Percy Lister, managing director of Messrs. R. A. Lister and Co., Ltd., has addressed a letter to the Prime Minister in which he suggests the creation of a fund for the purpose of advertising British goods in overseas markets. The proposal is that British industrialists should raise half-a-million sterling, and that the Government should provide a similar amount. Mr. Lister, on behalf of his company, offers to provide £5,000 if 99 other firms will do the same.

Employment during January.

The February *Ministry of Labour Gazette* states that during January employment in the engineering industry declined and was very slack on the whole, conditions being worse in nearly all districts. It was fairly good in electrical engineering, although some decline was experienced in this section. The number of unemployed in the engineering industry as a whole rose by 6,944 to 94,455, and the proportion from 8.9 to 9.6 per cent. The number of unemployed in the electrical engineering section increased to 4,249, the proportion rising from 4.7 to 5.3 per cent. In the electric cable, wire and lamp manufacturing group there was also an increase in unemployment, the number being 5,224 and the proportion rising from 4.9 to 6.1 per cent. The same applied to the electrical wiring and contracting industry, the total of 1,209 representing an increase from 6.4 to 7.8 per cent.

Craigweil House.

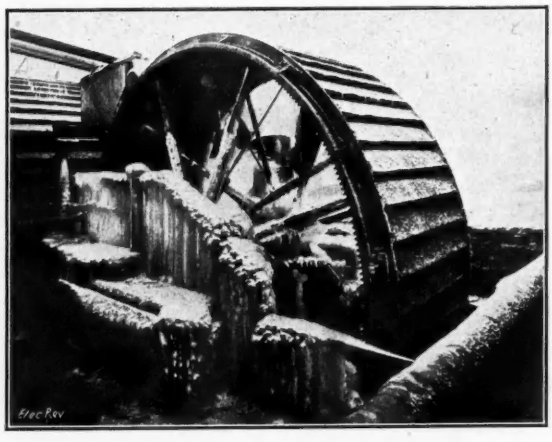
We have before us an interesting photograph received from Messrs. Berry's Electric (1928), Ltd., of Newman Street, Oxford Street, W.1, showing one of their motor vans leaving the gates of Craigweil House, the temporary residence of His Majesty the King, after delivering a large Berry-McClary electric cooker and hotplates, also a "Wilton" Magicoal electric fire for use in the dining room.

The Proposed Russian Visit.

The *Daily Telegraph* reports that the proposed visit of British industrialists to Russia will not now take place before March 8th, the date fixed upon. Delay has been caused by certain difficulties in organisation and arrangement, but the visit will be made later in the year.

Waterwheels Held Up by the Frost.

One of the results of the recent hard weather is illustrated in the accompanying picture. It shows one of the century-old



The D.P. Battery Co.'s Frozen Waterwheel.

water-wheels used by the D.P. Battery Co., Ltd., Bakewell, Derbyshire, which were put out of action by the freezing of the water supply.

Swedish Telephones for Rumania.

The *Industrie und Handels-Zeitung*, Berlin, has received information from its Bucharest correspondent to the effect that a group of Swedish capitalists has submitted to the Rumanian Government an offer to develop the country's telephone system. It is proposed to carry out a considerable extension by installing new exchanges in all the larger towns and bringing the network to the villages. The establishment of a factory for producing telephone apparatus is also proposed.

Bankruptcy Proceedings.

L. H. Lawrence, electrical engineer, 43, Canterbury Road, and Alexandra Road, Margate.—The first meeting of creditors was held on February 22nd at the London Bankruptcy Buildings, before Mr. E. T. Sanders, Official Receiver. The debtor filed his petition on January 16th, and has lodged a statement of affairs showing total liabilities of £1,049 (unsecured £1,001) and net assets valued at £517. He attributes his failure to lack of working capital, heavy overhead charges, and trade depression. The Official Receiver reports that the debtor commenced business on his own account in May, 1923, as an electrical engineer at Margate, without capital. He estimated his turnover for the year immediately preceding the receiving order to have been about £1,600, but states that in consequence of heavy overhead charges there was a net loss of £200. The meeting passed a resolution for the appointment of Mr. C. S. Scarlett, 5, Cecil Square, Margate, as trustee of the estate, with a committee of inspection.

T. F. Cowan, company director, 189, Regent Street, W.—The public examination of this debtor was held on February 20th, before Mr. Registrar Warmington, at the London Bankruptcy Court. The accounts showed assets £51, against liabilities £2,973, of which £2,371 represented the unsatisfied debts of a previous bankruptcy in 1927, from which proceedings the debtor had not applied for his discharge. Debtor stated, in reply to the Official Receiver, that in December, 1927, he, in conjunction with another person, formed Portable Wireless, Ltd., with a nominal capital of £500, to deal in wireless receivers; his associate gave him 251 shares in the company, of which he subsequently acted as director. After May, 1928, the company dealt in motor-cars and accessories; in September its name was changed to De Luxe Cars, Ltd., and he continued to act as director until disqualified by the present failure, which he attributed to his liability for £580 on guarantees. The examination was concluded.

E. C. Jenkins, 124, Cheltenham Road, Bristol, wireless dealer.—The first meeting of creditors was held on February 20th, at the Official Receiver's Office, Bristol. According to the statement of affairs there were liabilities expected to rank at £426 and a deficiency of £362. The debtor stated that he commenced business in August, 1926, without capital, as an electrical engineer at his residence. The business consisted mainly of jobbing work which he did himself, but in November, 1927, he rented a lock-up shop. He attributed his failure to bad trade, illness of his wife, and lack of capital. The case, being a summary one, was left in the hands of the Official Receiver as trustee of the estate.

H. H. D. Radcliffe and F. Haddleton, trading as "City Electric Services," 51, Islington Row, Birmingham, electrical engineers.—The first meeting of creditors was held on February 21st, at the Official Receiver's office, Birmingham, when the statement of affairs showed a deficiency of £332, with liabilities of £489, against assets of £157. The debtors attributed their failure to insufficient capital, loss on contracts, and excessive drawings of partners. They commenced trading in partnership in July last, Radcliffe having commenced the business in January, 1927. The business had never been a success, and they became aware of their position in October last. The matter was left in the hands of the Official Receiver as trustee.

H. J. Brownhill, back of 48, Whitehouse Street, Walsall, lately 34, Broadstone Avenue, Leamore, Walsall, electrical engineer.—The public examination herein was held on February 20th, at the Court House, Walsall. According to the statement of affairs there were liabilities estimated at £335 and a deficiency of £296. Debtor stated that his work had chiefly been the wiring of houses, but he had got into difficulties. He attributed his failure to competition and lack of capital. The examination was adjourned.

K. Jolivard & Co., electrical engineers, late of 66, Victoria Street, S.W.—The receiving order in this case was made at the London Bankruptcy Court on February 6th upon the petition of Messrs. Baxter & Caunter, Ltd., the act of bankruptcy alleged being failure to comply with the requirements of a bankruptcy notice. The first meeting of creditors was held on February 18th, when it transpired that no one had then surrendered to the proceedings. The case was left in the hands of the Official Receiver.

E. G. Batt, electrical engineer, 20, Iverna Gardens, Kensington, W., and Magnet House, Kingsway, W.C.—Trustee, Mr. H. E. Cooper, 1-2, Bucklersbury, E.C., released December 20th, 1928.

J. R. Hereford-Lavey and V. De Frece (Radio Cash Stores), electricians, 371, Upper Street, Islington, N.1, and 5, New Station Street and Parliament Street, Nottingham. Trustee, Mr. C. Latham, 78, New Oxford Street, W.C., released January 10th.

H. A. Sanders, electrical contractor, The Black Cat Restaurant, Chawston, Beds.—Trustee, Mr. H. Ball, Duke Street, Bedford, released February 6th.

G. Dodd, wireless dealer, Arches, and Radcliffe Road, Crimble, Golcar.—Trustee, Mr. J. O. Morris, Official Receiver, 12, Duke Street, Bradford, released February 11th.

Company Liquidations.

Attaix, Ltd., wholesale electrical and wireless dealers, late of 106, High Street, Southampton.—A meeting of creditors was held on February 19th at the Institute of Chartered Accountants, E.C. The chair was occupied by Mr. K. M. Scott, of Messrs. Merrett, Son & Street, 32, Finsbury Square, E.C., who reported that a receiver for the debenture holders had been appointed, and the usual resolution for voluntary liquidation had been passed. The statement of affairs submitted showed net assets estimated at £7,348 to meet the claims of the debenture holders totalling £7,416. There was thus a deficiency as regarded the debenture holders of £68, and there were no assets available for the unsecured creditors, whose claims aggregated £2,335. The ranking liabilities were put down at £2,403, with a deficiency of the same amount. The issued capital of the company was £7,170, and the deficiency as regarded the shareholders was £9,573. The company was registered in 1925, with a capital of £1,000, which was subsequently increased in stages to £8,000. The issued capital of £7,170 was all fully paid up, and shares to the value of more than £5,000 had been issued for cash. In 1926 the company acquired freehold premises at Southampton for £5,000, arranging loans of £4,000 for the purpose by mortgages. In the course of the trading there was an overdraft which varied from £1,000 to £2,000. In 1927 the Marconi Wireless Telegraph Co. alleged that the company was infringing patents in regard to wireless sets and convertors, but it was advised by patent agents that the sets, which were of French manufacture, did not infringe the Marconi patent. The board, however, came to an agreement with the Marconi company to pay a certain royalty. A guarantee provided with the sets involved the company in some expense. A sum of £7,000 was borrowed from a new bank, on the security of debentures, and that was utilised as to £4,300 in discharging the claim of the old bank, whilst £1,000 went to the second mortgagee of the premises. The balance was used in the business. The Marconi Company did not receive anything on

account of royalties, and commenced proceedings. About the same time one of the company's sub-agents for convertors commenced proceedings against the company in the High Court. The company was successful in the latter action, but the sub-agent's business went into liquidation. Last November the bank appointed a receiver, who had disposed of the stock, &c., for £6,700, and was also collecting the book debts. The creditors decided that the voluntary liquidation should be continued with Mr. Scott as liquidator.

The following are creditors :—

	£		£
Blackwell & Co.	34	Obree & Co.	23
Electric Conduits, Ltd.	96	Revo Elec. Co., Ltd. ...	96
Electric Cables, Ltd. ...	140	Radia, L. L.	45
Einar Ekstrom	186	Roberts, Boone & Hellyar	24
Fuller Accumulator Co., Ltd.	28	Schlethawrer, L. F. ...	46
Bailey, L. N. H.	229	Scupham & Wood ...	22
Douglas Advt. Co. ...	104	Schwarzstein, R.	92
Gaisser, C., & Co.	135	Soc. des Lampes	25
General Accessories Co., Ltd.	30	Seem Accumulateur ...	40
Herbelot & Vorms ...	146	Rogers, S.	43
Iliffe & Sons, Ltd. ...	44	Ward & Goldstone, Ltd.	43
Lamport, Bassett & Hiscock	90	Wolf Arns	35
Moore, H. A., & Co. ...	46	Watson, S. G.	65
Mewburn, Ellis & Co. ...	55	Zik-Zak	58
Nathan, J. F.	34	Marconi's Wireless Telegraph Co., Ltd. (approx.)	500

WHITFIELD ELECTRICAL CO., LTD.—A petition for the winding up of this company has been presented to the County Court of Hertfordshire by Messrs. Hailwood & Ackroyd, Ltd., of Beacon Works, Morley, and will be heard at Barnet on March 5th.

EPOCH ELECTRICAL SOCIETY, LTD.—A meeting of creditors was held on February 28th at the offices of the liquidator, Mr. C. Hughes, 24-25, Ironmonger Lane, E.C.

MALDON ELECTRIC WORKS, LTD.—Winding up voluntarily. Liquidator, Mr. A. F. Lovell.

Central Electricity Board.

In our advertisement columns to-day the Central Electricity Board invites tenders for the following :—North-West England and North Wales Electricity Scheme, 1928—33,000-V overhead transmission lines.

New French Company.

A company has been formed in Paris (38, Rue de Mont Thabor), with a capital of 600,000 fr., and the title La Société de Matériel Electrique et Mécanique.

New Catalogues and Lists.

Messrs. WHEELER & ESSER, 7, Upper Marylebone Street, W.1.—A price list of electric candle tubes.

The CREDENDA CONDUITS CO., LTD., Oldbury, Birmingham.—An illustrated pamphlet dealing with a new form of oven temperature indicator. Priced.

X-RAYS, LTD., 47, Red Lion Street, W.C.1.—A priced and illustrated mailing card describing the "Thermo-Tank" for developing, &c., X-ray negatives.

The VALE-ROYAL ELECTRIC LAMP MANUFACTURING CO., LTD., Vale Royal, York Road, Islington, N.7.—A price list of electric lamps with straight and spiralised filaments, &c.

Messrs. J. B. BROOKS & Co., LTD., Criterion Works, Great Charles Street, Birmingham.—Illustrated pamphlets advertising the company's patent steel tools and "Evertaut" steel chairs.

The PARSONS OIL ENGINE CO., LTD., Town Quay Works, Southampton.—Catalogue No. 98, fully describing with illustrations and diagrams the company's latest 10-20-h.p. petrol engine.

The REGENT LAMPSHADE CO., 16, Brighton Terrace, Brixton, S.W.9.—Priced pamphlet illustrating a new line of vellum lampshades.

SWITCHGEAR & COWANS, LTD., Elsinore Road, Old Trafford, Manchester.—Section No. 27-2 of their catalogue well illustrating and describing their outdoor type motor-operated induction regulator.

Sir W. G. ARMSTRONG, WHITWORTH & Co., LTD., Kinnaird House, Pall Mall East, S.W.1.—47-page illustrated publication setting forth brief particulars both of their works and their products. The information is given in three languages—British, French and Spanish—and will have a wide circulation throughout the world, through the company's overseas agents. Engineers, technical schools, libraries and students are invited to apply for copies.

HIGGS MOTORS, Witton, Birmingham.—February stock list of a.c. motors and d.c. motors and dynamos.

MESSRS. PATERSON & SERVICE, 38, Bath Street, Glasgow.—A priced and illustrated leaflet dealing with "Feno" electric radiators.

THE BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, W.C.2.—A folder containing illustrated notes on the company's electric refrigerators, with a separate price list.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—An album containing 15 views of the company's cable works, &c. The titles are printed in five languages.

CROSSLEY BROS., LTD., Openshaw, Manchester.—Publication 1240, illustrating and describing the company's compressorless Diesel engines.

WILD-BARFIELD ELECTRIC FURNACES, LTD., North Road, N.7.—Catalogue Section C/F and J, describing industrial electric furnaces with automatic temperature control. Illustrated.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2.—Publication No. 401, containing illustrations and prices of "Phililite" fittings which are supplied already wired.

THE JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1.—List D.C. (p. 58), containing a full illustrated description of the company's "No. 46" electric cooking cabinet. Priced.

THE MARCONIPHONE CO., LTD., 210-212, Tottenham Court Road, W.1.—Three adhesive window bills advertising the company's hire-purchase system, moving-coil loud speakers and h.t. radio batteries.

The Economic Mission to Australia.

Upon his return from Australia last Friday, Sir Hugo Hirst, Bt., was interviewed by a *Daily Telegraph* correspondent with regard to the work of the British Economic Mission in the Commonwealth. Sir Hugo said that although at first they met with suspicion, that phase passed, and it was a source of satisfaction to them that they were largely responsible for bringing about the first "peace in industry" conference in Australia. He was convinced that the bulk of the Australian people desired to co-operate in trade and other matters with the United Kingdom. As a result of persistent propaganda and concerted business efforts other countries had succeeded in planting themselves deeply in the commercial and industrial life of Australia, and it was high time that a resolute effort was made by Great Britain to assume her proper position in the face of that competition. We must offer Australia freely of our financial and technical assistance if trade between the two countries was to increase as it should. The social conditions in Australia and the standard of living there implied a great purchasing power, and altogether there was a big field for trade expansion between the Commonwealth and ourselves.

Recent Contracts.

Among the more important orders recently received by Messrs. YARROW & Co., LTD., are the following :—One Yarrow boiler, for 50,000 lb. per hour normal evaporation, fitted with mechanical stoker and arranged to work under balanced draft in conjunction with an air heater for Messrs. Brown & Adam, Ltd., Glasgow. Messrs. Yarrow are main contractors for a complete boiler-house plant for the India Rubber, Gutta-Percha & Telegraph Works Co., Ltd., including building, coal- and ash-handling equipment, pipework and valves, the boiler plant itself comprising three boilers each for 40,000 lb. per hour normal evaporation with superheaters, economisers, chain-grate stokers, fans, &c. Two boilers, each for 50,000 lb. per hour normal output, and including superheaters, economisers and chain grate stokers, fans, chimney, &c., are being supplied to Harrogate Corporation. Here again Messrs. Yarrow are main contractors, the work including also the boiler-house building, and coal- and ash-handling plant.

EGYPTIAN RAILWAY ELECTRIFICATION CONTRACT.—It was reported this week that tenders had been opened for the electrification of the Helouan railway line to Cairo, and that the lowest was that of the English Electric Co., Ltd., at £261,570.

The Co-ordination of London Traffic.

The London and Home Counties Traffic Advisory Committee has considered the Bills providing for the co-ordination of the transport systems of the "Underground" group and the London County Council, and expresses approval of the measures. The Minister of Transport is advised to facilitate their passage through Parliament. There were three dissentients from the report, who considered that the systems should be under the supervision of a public body.

Visit to English Electric Works.

On February 12th a party of students from the University of Cape Town paid a visit to the "English Electric" works at Stafford. The students were under the care of Professor A. E. Snape and Mr. G. Stewart, and the tour of the works was carried out in accordance with a pre-arranged programme; an expert was present in each department to explain the various processes and special features of design. Informal addresses on technical subjects were given later on in the Guest House. Before returning to London the party was entertained to dinner, and in speeches made by two of the visitors the view was expressed that the English Electric Co., Ltd., had no reason to fear comparison with the electrical works which they had seen in Germany.

Morgan Crucible Russian Director Arrested.

The Riga correspondent of *The Times* reported on February 18th that the Soviet authorities had commenced to liquidate the Leningrad branch of the Morgan Crucible Co., Ltd., and had ordered the trial of its director, M. John Volfman and others. The business has never been nationalised and its preservation has been due to a great extent to M. Volfman. The Soviet Government opened a crucible works of its own in 1924, but the products are said to have been unsatisfactory.

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The charges against M. Volfman are that the success of his business has been due to the bribing of officials to place orders. The defence says that the charges are ridiculous, as the works has never had to seek orders, being unable to cope with the work received without solicitation. The trial was opened in Leningrad on February 20th, an agent, two engineers and a foreman being joined as defendants with M. Volfman.

The Times reports that the evidence offered against the accused men was of such a trivial character that the tribunal would not convict. Thereupon the prosecutor preferred a charge of espionage, and the discovery of a "plot" was alleged.

Employés' "Dabbling" at Monmouth.

The National Federated Electrical Association recently wrote to the Monmouth Corporation pointing out that the position of electrical contractors in the district was being prejudiced by the amount of work which employés of the Electricity Department were carrying out in their spare time. The Corporation took no action, and the N.F.E.A. has therefore written again, stating that the attention of the Minister of Labour is being drawn to the matter. It is alleged that some of the work done by employés of the Department is of a deplorable nature which would still further damage local contractors' prospects. The letter encountered some hostility from the Council, but a Labour member considered that the matter should be investigated. It was decided, however, to await the reply of the Minister of Labour before taking any action.

For Sale.

The directors of the Great Southern Railway Co. (Ireland) invite offers for d.c. motors, pillar controllers, a 500/570-h.p. Belliss & Morcom engine, &c. By order of the receiver for the debenture holder, Messrs. W. B. Hallett, Fox & White will sell by auction on March 5th, at 161, Wardour Street, the machinery, equipment and stock of an electrical advertisement sign manufacturer. (See our advertisement pages to-day.)

A Polish Marconi Company.

Works have recently been started in Poland by the Polskie Zahlady Marconi, a concern which is affiliated with the Marconi Co., for the manufacture of radio transmission and reception apparatus for the Polish market. Chief attention is being devoted to crystal and valve receivers and loud speakers made in accordance with the Marconi patents.

Wages in the Engineering Industry.

A conference of representatives of the engineering trade unions was held in London on February 22nd, at which the report of a special committee which had been studying the ability of the industry to pay higher wages was considered. The report was accepted, and it was decided that the conference should meet again in May.

Unemployment.

The total number of registered unemployed on February 11th was 1,342,500. This represented a decrease of 26,980 as compared with February 4th, when the total was 1,369,480. At the corresponding date of last year (February 19th) the total was 1,159,772.

Book Notices.

"Aluminium Bronze." Pp. x+76; illustrated. London: British Aluminium Co., Ltd.—In its useful tables, appendices, and selected bibliography, this well-produced booklet deals with the remarkable range of properties and wide potential application of the metal.

A reprint from the *Lancet* contains the results of an investigation into the action of foodstuffs on aluminium utensils.

"Science Abstracts" A and B. Indexes to Vol. XXI. 1928. 3s. each net. London: E. & F. N. Spon, Ltd.

"Railway Electrification and Traffic Problems," by P. Burtt. Pp. xvi+197; figs. 23. London: Sir Isaac Pitman & Sons, Ltd. Price 10s. 6d. net.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLVIII. February. No. 2. New York: The Institute. Price $1.

"Maste und Türme in Stahl," by Dipl. Ing. P. Sturzenegger. Pp. vi+218; figs. 362. Berlin: W. Ernest & Sohn. Price 23 Rmk.

Social Events.

On February 16th the staff of the Greenwich Cable Works, Ltd., held a dinner to celebrate the company's forthcoming move from Greenwich to new works at Croydon. A number of prizes were given for dancing, humorous songs, and a Limerick competition. The chairman (Mr. J. H. C. Brooking), in reply to the toast of the company, made special mention of the chairman of the company (Mr. Sam Bibby), who was unable to be present; he had served the company since it was formed in 1902.

The A.T.M. Golf Club, whose membership is drawn from the personnel of the Automatic Telephone Manufacturing Co., Ltd., held its fourth annual dinner on February 16th at the Childwall Abbey Hotel; Mr. T. A. Eades presided over a gathering of some fifty members and friends. Apart from some enjoyable musical items, a novel entertainment followed the dinner, taking the form of a film display showing well-known members of the club on the Bowring Park Course. The originals were photographed on the links by Mr. G. W. B. Pope. The prizes and trophies won during the season were presented by Mr. Eades.

New Municipal Showrooms.

The Douglas (Isle of Man) Town Council has decided to open showrooms, &c., in Ridgeway Street in connection with the electricity undertaking, and the borough electrical engineer has been authorised to obtain the necessary electrical appliances at an approximate cost of £500.

Trade Announcements.

Mr. J. W. Norton has severed his connection with Messrs. Bathe's radio department, and opened business as Norton and Shapley at Radio House, 23, Lucius Street, Torquay.

Messrs. Buck & Hickman, Ltd., 2, Whitechapel Road, E.1, have taken over the business of Messrs. John Phillips and Co., Walworth Road, S.E.17, inventors and manufacturers of commutator grinders and notchers; the business will be conducted at the Whitechapel Road premises, remaining under the supervision of Mr. G. L. Precious, the present proprietor.

Messrs. H. T. Boothroyd, Ltd., Bootle, Liverpool, have opened an office at 62, Great Russell Street, W.C.1.

Messrs. Brookes (Oldbury), Ltd., announce that they have purchased the business of the Regent Sheet Metal Machine Tool Co., Ltd., Wakefield, which will in future be carried on at Oldbury. A catalogue of "Regent" guillotine and rotary shears has been received.

Messrs. T. Mason & Co., suppliers of electric motors, machine tools, &c., have removed to 95, Belmont Row, Birmingham. (Telephone: Aston Cross 2400.)

From March 4th the telephone number of Messrs. Wm. Cory and Son, Ltd., and their associated companies will be Monument 2500 (twenty lines).

The address of Messrs. George Becker, Ltd., is now 39, Grafton Street, Tottenham Court Road, W.1. (Telephone: Museum 7439).

Prices of Raw Materials.

In the course of their letter dated February 23rd Messrs. James Forster & Co. state that consumption of lead in this country remains good, while arrivals are likely to be light for the next three weeks, although more lead is expected during the latter part of March and early April. The Continent has been quiet, due no doubt to the severe weather prevailing there, but a revival in demand from that quarter should be seen. The intrinsic position of the metal is sound; stocks are small, and higher values yet will probably be gained.

Messrs. F. Smith & Co., and Messrs. James & Shakespeare report, February 26th: No change in copper prices.

Messrs. James & Shakespeare report, February 26th: English pig lead, £24 15s., 5s. inc.

Messrs. Edward Till & Co. report, February 26th: India rubber, Para fine, 1s. 1½d., ½d. inc.

Lighting and Power Notes.

Armitage (Staffs.).—Inauguration of Supply.—An electricity supply was recently switched on by the chairman of the Parish Council. The supply has been provided by the Trent Valley and High Peak Electricity Co., which held a two-days' exhibition of electrical fittings.

Aylesbury.—Overhead Lines.—The Town Council has decided to proceed forthwith with the construction of overhead transmission and distribution lines in the rural area at a cost of £13,973. The work is to be completed within a year.

Barnes.—Electricity Supply.—At an estimated cost of £7,243, work is to be carried out by the Electric Lighting Committee to provide for future development, correction of pressure regulation and greater flexibility in supply. Subject to an approved agreement with Messrs. Watney, Combe, Reid and Co., Ltd., a duplicate 500-kW unit is to be installed at the Mortlake brewery sub-station at a cost of £2,500.

Bedford.—Year's Working.—The accounts of the Corporation electricity undertaking (engineer: Mr. R. W. L. Phillips) for the year ended March 31st last show a total income of £96,780 and working expenses of £54,018, leaving a gross profit of £42,761. The figures for the preceding year were: Income, £94,077; working expenses, £55,839; gross profit, £38,238. To the gross profit was added unemployment relief grants and interest on investments, making a total of £46,605 available, of which capital charges absorbed £44,931, leaving a net surplus of £1,674, as compared with £2,815 in 1926-27. A contribution of £1,379 was made to the borough fund. The capital expenditure during the year amounted to £60,377, the chief item being £31,714 for mains. The electrical energy sold increased from 12,808,113 to 15,198,879 kWh, and the maximum supply demanded from 5,350 to 6,980 kW.

Bingley.—EXTENSION OF SUPPLY.—The Electricity Committee recommends the extension of electricity supply by the Urban District Council to property in the rural districts of Keighley and West Morton, that sanction be sought to borrow £3,500 and £470, respectively, and that the Ministry of Transport be asked for authority to the erection of overhead lines.

Bury St. Edmunds.—LOAN.—The Town Council has applied for sanction to a loan of £4,180 for mains.

China.—SHANGHAI.—Mr. T. H. U. Aldridge, engineer-in-chief and manager of the municipal electricity undertaking, has sent us the following comparative statistics showing the continued development of the undertaking:—The sales of electricity during 1928 totalled 458,360,215 kWh, as compared with 400,343,385 kWh in 1927, the increase in the supply for power and traction, which rose from 350,224,626 to 401,512,721 kWh, being mainly responsible. It is interesting to note that the actual sales exceeded the estimates for the year by 10,760,215 kWh.

Continental.—SWEDEN.—At the end of last year the development of water power in Sweden totalled 1,474,000 h.p. In 1928 extensions of existing power stations and construction of new stations were commenced, to yield an additional 33,000 h.p., and, together with the work commenced before 1928, an additional 130,000 h.p. is in preparation at private stations. No new Government-owned station was begun during 1928, but the extension which had been going on since 1926 of the Porjus power station by a seventh unit of 18,000 h.p. was continued. The annual increase in the consumption of electricity from stations belonging to the central system of Government-owned works is about 50,000,000 kWh. In order to meet this steady increase, it is estimated that new developments will be necessary in about four years, and construction will probably be put in hand of a water power station at Vargoen, which could be completed in three or four years and would supply an additional 115,000,000 kWh. Next would come the exploitation of waterfalls on the Motala river and of the Tyttbo falls on the Dal river, the latter of which, it is estimated, would yield about 80,000,000 kWh. By these measures and the regulation of the Vaener lake, which supplies water to several power stations, the demand for electricity could be met for at least the next ten years.—*Reuter's Trade Service* (Stockholm).

ITALY.—Approval has been given to a proposal of the Società Generali Elettrica dell' Adamello, to erect a 125,000-V transmission line between the power station at Cedegolo and a substation at Gorlago, province of Bergamo, and to the Società Elettrica Bresciana, of Brescia, to erect a 40,000-V line between Narda, Pisogne and Sale Marasino.

Croydon.—MAINS EXTENSIONS.—The Corporation Electricity Committee is to extend mains at a cost of £1,042.

Glasgow.—PROGRESS DURING JANUARY.—Under the Corporation Electricity Department's scheme 387 houses were wired in January, making the total to date 11,578, while hired appliances numbered 372, making the total 18,221.

MAINS EXTENSIONS.—The Electricity Committee has recommended that distributing mains be laid, at a cost of £2,103.

Irish Free State.—DUNDALK.—At a recent meeting of the Urban District Council it was suggested that the Electricity Department be called on to reduce the price of electricity for lighting from its present price of 10d. per kWh to 6d. per kWh. The matter was referred to the Electricity Committee.

Lincoln.—INSTITUTION SUPPLY.—The Visiting Committee of the Bracebridge Mental Hospital has approved a scheme of improvements to the lighting and heating submitted by the engineer. The scheme involves extensions being carried out to the boiler-house, engine-room and dynamo-room, and additional plant. The engineer states that the existing generating plant is inadequate for the present demands, and he estimates the cost for the engineering portion at £6,000. The architect states that a further £7,700 will be required for structural alterations.

Liverpool.—ELECTRICITY SUPPLY PROGRESS.—Members of the City Council have received from the Electric Power and Lighting Committee, a report by Mr. P. J. Robinson, city electrical engineer, dealing with the electricity supply arrangements for the city. He points out that an increasing proportion of the load has been transferred from the Lister Drive Nos. 1 and 2 stations to the more efficient No. 3 station. The first of the three new pulverised fuel boilers has been in operation since the middle of December. Another would be ready by the end of February, and the third some time after. The pulverised fuel system has enabled cheaper grades of fuel to be used with a corresponding reduction in the generating costs. This reduction should increase when the other two boilers are in service. The Committee's estimates show an expenditure of £1,311,918 on capital account, £102,085 on reserve and renewal account, and £1,388,169 on revenue account. The main item of expenditure will be in connection with the scheme for the erection of the new riverside power station at Clarence Dock and covers purchase of land, civil engineering work, plant, buildings, &c. No further extensions are anticipated at Lister Drive power station, but provision has been made for the erection and equipment of static sub-stations which may be required in various districts as necessity demands, h.p. mains from Clarence Dock to Pumpfields, and h.p. mains to supply Whiston and Sefton rural districts if the application of the Council for a Special Order is successful.

London.—WANDSWORTH.—The Special Electricity Committee of the Borough Council, in a report on the two-part tariff proposals of the County of London Electric Supply Co., Ltd., states that it does not consider the proposals are a satisfactory response to the public demand for a reduction in the charges for electricity. The Committee has informed the Electricity Commissioners that the Council desires that the inquiry held last May into its application for a reduction of the maximum price which the company may charge under the Wandsworth Electric Lighting Order, 1892, which was adjourned, should be resumed at the earliest convenient date.

BERMONDSEY.—The Borough Council Electricity Committee has reported that, in view of the altered conditions for the bulk supply of electricity to the Council from the London Electric Supply Corporation, the borough electrical engineer has been in communication with the London County Council with a view to the revision of the terms for the supply of electricity by the Council for the tramways. The following terms have now been accepted by the L.C.C.: The Borough Council to supply the necessary power, on the basis of a maximum demand of 1,000 kW at a pressure of about 600 V, and at a cost of 0.86d. per kWh delivered to the d.c. track switchboard, subject to adjustment in respect of variations in the cost of coal.

Mexborough.—INAUGURATION OF NEW PLANT.—New plant, consisting of two 1,000-kW convertors, installed for the purpose of converting a bulk supply from the Yorkshire Electric Power Co. to d.c. for local distribution, was put into commission by the chairman of the Electricity Committee at the Urban District Council's power station on February 14th. The station has cost £12,000.

Millport (I. of Cumbrae).—ELECTRICITY SUPPLY.—The Town Council is inquiring into the possibility of introducing electricity by a submarine cable from the Ayrshire mainland. It is estimated that the cost would be about £3,000.

Mirfield.—ASSISTED WIRING SCHEME.—The Urban District Council has approved an assisted wiring scheme for dwelling houses, the installations to be carried out by the Council or its agents. Where not more than five lighting points are required, the price of electricity will be 1½d. per kWh in excess of the ordinary lighting rate until the cost of the installation is paid. In cases of from six to ten points the repayment is to be by quarterly charges, with electricity at the ordinary rates.

Okehampton.—SPECIAL ORDER OPPOSITION.—The Town Council has decided to oppose an application which is being made by Mr. W. G. Heath, of Plymouth, for a Special Order authorising him to supply electricity within the borough.

Preston.—LOANS.—The Electricity Commissioners have sanctioned a loan of £42,000 for works in connection with the provision of additional main transmission lines between Blackpool and Preston.

The Corporation Electricity Committee is applying for sanction to a loan of £23,000 in connection with the supply of electricity to Kirkham.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

STRATFORD-ON-AVON.—*The Shropshire, Worcestershire and Staffordshire Electric Power Co.*—The flat rate for electricity reduced by 1d. per kWh.

MAIDSTONE.—Power: intermittent use, from 3d. to 2d. per kWh during factory hours, and from £7 per annum per kW of maximum demand, plus 1d. per kWh to £6 and 1d.

BOLTON.—Lighting: from 4½d. to 4½d. per kWh. Heating and cooking on business premises: from 1d. to ¾d. per kWh. Industrial power: a reduction of approximately 3 per cent.

TORQUAY.—Rates of ¾d. and 1d. per kWh respectively for the Borough, Newton Abbot, Abbots Kerswell, Coffinswell, and Kings Kerswell, reduced to ¾d. per kWh. Rates of 1½d. and 1¾d. per kWh in the remaining area of supply reduced to 1¾d. and 1¼d. Discount for prompt payment of accounts reduced from 5 per cent. to 2½ per cent. Special sliding scale, power rate, to be revised so that the lowest price will be ¾d. instead of 1d. per kWh.

BARNES.—Private lighting: flat rate, from 3½d. to 3d. per kWh, the charge up to 26 kWh supplied per quarter to be 6s. 6d., with 1s. meter rental; ratable value tariff: fixed charge of 7½ per cent. on ratable value, instead of 10 per cent.

DEPTFORD.—*The London Electric Supply Corporation, Ltd.*—Lighting: first 2,000 kWh per annum, 5½d. per kWh; next 2,000, 5d.; beyond, 4½d. Power: first 10,000 kWh per annum, 2d. per kWh; next 15,000, 1¾d.; beyond, 1½d. Heating and cooking: 1½d. per kWh. Exterior shop and sign lighting: 4d. per kWh. Shop lighting after 8 p.m.: 2½d. per kWh. Private dwelling houses: "All-in" domestic tariff, 1d. per kWh, plus a fixed quarterly charge.

HALIFAX.—Lighting: From 7d. to 6d. per kWh.

LAUNCESTON.—*Launceston and District Electric Supply Co., Ltd.*—Power: From 4d. to 3½d. per kWh. Heating: From 2d. to 1½d. per kWh.

Ross-shire.—HYDRO-ELECTRIC SCHEME.—The new hydro-electric supply in Ross-shire has been handed over by the contractor, and is now in general use between the generating station at Lochluichart and Invergordon, serving also Dingwall, Strathpeffer, and other centres. The line is being extended to Tain, and farms along the route are being offered supplies on special terms.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by Liverpool Corporation authorising it to extend its area of electricity supply so as to include the rural district of Sefton, and parts of the rural district of Whiston; the Ilfracombe Electric Light and Power Co., Ltd., to supply electricity in part of the rural district of Barnstaple; and the Central Sussex Electricity, Ltd., to amend the Haywards Heath and District Electricity (Extension) Special Order so as to include parts of the parishes of Clayton and Hurstpierpoint.

Stoke-on-Trent.—Loans.—The Corporation Electricity Committee is applying for sanction to the following loans:—Mains extensions, £7,620; e.h.p. feeder, £17,000; change-over in various districts, £10,800; supply to sewage works at Ford Green, £800.

Weymouth.—Loan Sanctioned.—The Corporation Electricity Committee has received sanction to the borrowing of £19,464 for mains and £2,238 for sub-station equipment.

Tramway and Railway Notes.

Brighton.—Proposed Abandonment of Tramway.—The Corporation has under consideration a scheme for the gradual replacement of the tramway service by motor omnibuses. It is proposed to form a new statutory company providing for a merging of the interests of the Corporation tramway and the Brighton and Hove section of the omnibus system of Messrs. Thomas Tilling, Ltd. The company would replace the tramcars by omnibuses, and generally improve the transport facilities of the district. The draft heads of agreement include the payment by the new company of a perpetual annuity of £10,000 to the Corporation, the board of the company to consist of three representatives of the Corporation and three representatives of Messrs. Tillings, and the permanent chairman of the board always to be a representative of the company. The capital of the new company would total about £750,000, of which £300,000 would represent interests of the Corporation. The Corporation General Purposes Committee has postponed consideration of the scheme for two months, and in the meantime the Town Clerk has been instructed to obtain counsel's opinion with regard to the promotion of a Parliamentary Bill on the lines of the draft agreement.

Continental.—France.—The authorities of the Midi Railway have lately submitted plans to the French Ministry of Public Works for the electrification of the railway between Beziers and Neussargues.

London.—"Underground" Improvements.—Of 101 new cars ordered for the District Railway, 25 are now in service, and the remainder are being delivered at the rate of three a week. These cars contain many new features which add considerably to the passengers' comfort and the more efficient working of the train. As regards the operating of the new cars, the motors are of a higher-powered and speedier type; acceleration and deceleration also is automatic and more rapid than in the older rolling stock. Work is in hand at Acton works to completely re-equip 410 of the older cars with the latest type of motors and driving equipment, and, to date, 54 cars have been dealt with. One of the old-type escalators at Oxford Circus, in service since 1912, is to be converted to one of the latest comb pattern. The new escalator will have a speed of 100 ft. per minute, as compared with the present 90 ft. There are now five escalators at this station, handling a daily traffic of 90,000 passengers. On the whole Underground system there are 83 escalators, of which 15 have been installed in the last 12 months.

Salford.—Co-operation Proposals.—By a resolution passed by the Tramways Committee on February 19th, the Corporation is seeking to settle its difficulties with neighbouring local authorities with regard to the working of the Corporation tramway and omnibus services in their areas. According to *The Times*, the Committee, with a view to effecting an amicable settlement, has now instructed the Town Clerk to address to Prestwich, Eccles, and Swinton a letter suggesting that a satisfactory solution of the difficulties existing might be found in the setting up of a joint tramway and omnibus board for all tramway and motor-omnibus services worked by or leased to the Salford Corporation. The view is taken that omnibus competition must eventually damage the tramways of all the districts. The remedy, in the opinion of Salford, lies in treating tramway services and omnibus services as one system, provided that the privately-owned omnibus companies can be kept off the routes. The Corporation would undertake to run an adequate service of motor omnibuses if the various authorities concerned would agree not to renew existing licences for omnibuses in their respective districts or grant any new licences for the running of motor omnibuses in these districts except to the Corporation omnibuses. The Corporation is prepared to withdraw the private Bill it has promoted in the present Session of Parliament, and is willing to promote a new Bill next Session to constitute and incorporate the tramway and motor-omnibus board, consisting of representatives of the constituent authorities, or, alternatively, a Bill to enable it to submit to the Ministry of Transport a scheme or schemes for the constitution of such a tramway and motor-omnibus board. Each Council has been invited to send representatives to a conference on the question, to be held at Salford Town Hall shortly.

Sunderland.—Track Extension.—The Ministry of Transport has notified the Corporation that it is prepared to confirm the Light Railway (Extension) Order, permitting the Corporation to extend its Durham Road tramway for three-quarters of a mile to the Humbledon housing estate. The estimated cost of the scheme is £20,266.

United States.—New York.—A fire which broke out in the tube under Hudson River resulted in injuries to about 50 passengers. It is stated that the fire was caused by the spark of a preceding train igniting oil on the track. The driver of the train which followed attempted to dash through, but when the third coach was over the fire there was a short-circuit which brought the train to a halt and cut off the lights.

Telegraph and Telephone Notes.

Rumania.—Telephony.—It is reported from Bucharest that the Government is in possession of a proposal made by a Swedish financial group which offers to undertake and carry out the extension of the telephone network in Rumania. The group proposes to connect all the communes in the country with the telephone network, to establish new exchanges in the towns, and to erect and carry on a works in Rumania for the production of technical material. The offer is being examined by the Government.

Ship-Shore Communication.—New Station.—A coastal wireless station at Parkeston and three new steamers for the L. & N.E. Railway Co.'s continental route, *via* Harwich-Hook of Holland, are to be equipped with Marconi valve transmitting apparatus. The interrupted-continuous-wave method of signalling will be used and the transmitters will each have a power of 1½ kilowatts and work on wave-lengths between 600 and 800 metres. The use of valves instead of the older spark method of signalling has many advantages: interference, even on the same wave-length, can be reduced considerably, and the arrangement is such that the power of transmission can be reduced to about one quarter of the full range of the installation. If the distant receiving station complains of interference, an alteration in the speed of the generator of the transmitter will produce an alteration in the tone of the transmitted signal, which can be made sufficiently distinct from the interfering signal to allow communication to continue without delay. The power of transmission can be reduced in small stages, making it very convenient for communicating over short distances only, and also reducing the amount of interference with other wireless services.

The Telephone Service.—Yorkshire.—The annual report on progress in the West Yorkshire district, prepared for the Advisory Committee (superintending engineer: Mr. J. W. Atkinson, M.I.E.E., North-Eastern District, Leeds) shows that in 1928 the number of lines increased by 4.54 per cent. to 42,674, and the number of stations by 4.72 per cent. to 65,540; some 41.5 per cent. of the lines and 42.5 per cent. of the stations were automatic. Trunk calls numbered 5,859,892 and local and junction calls 39,782,024; phonograms sent by subscribers numbered 430,242. Street kiosks increased by 132 to over 500. During the year five automatic and five manual exchanges were opened, while nine automatic and 10 manual ones were in progress.

York.—During 1928 stations increased by 6.7 per cent. to 27,843, of which 9,397 were automatic, and only 20.29 per cent. was at the residence rate. Effective trunk calls increased by 7.4 per cent. to 2,718,829, and the local calls amounted to 12,900,000, an increase of 10.6 per cent. Phonograms increased by 5 per cent. to 325,775.

Transatlantic Telegraphy.—Tariff Reduction.—The rates charged for lengthy night submarine cable and wireless telegraph messages from Gt. Britain to North and South America and Eastern Canada, were reduced last week by the Western Union Telegraph Co. and Marconi's Wireless Telegraph Co., Ltd. Week-end message rates have also been revised.

United States.—Ford Wireless Station.—The Ford Motor Car Company has applied for permission to erect a new wireless station to enable it to communicate with the Ford rubber plantations in Brazil for both private and limited public service.—*Reuter's* (Washington).

Telephone Revenue.—The combined gross operating revenue of all telephone companies in the United States in

1928 has been estimated at $1,100,000,000, an increase of 7 per cent. over 1927. More than 19,300,000 telephones are estimated to be now in use throughout the United States. The combined investment in telephone and telegraph systems is estimated roughly at slightly over $4,000,000,000, and their combined gross operating revenues are estimated approximately at $1,260,000,000.

West Africa.—RADIO STATION.—A wireless station is being built at Takoradi, Gold Coast. It will be equipped for communication with other West African colonies, says *The Times*, and to link up with the nearest stations of the main Empire service.

Radio Notes.

Licences.—RECORD INCREASE.—According to the British Broadcasting Corporation's estimates, the number of listeners during December, 1928, and January, 1929, increased by about 500,000, one of the biggest advances recorded. The increase in the number of licences for the two months is stated to be over 120,000, and is 20,000 more than the figures for the same months last year. The number of licences now current is 2,684,941.

Jugo-Slavia.—LICENCES.—Before the opening tests last September of the new transmitter at Ljubljana, which serves the whole of Slovenia, Zagreb was considered the "local" station for Slovenia. When Ljubljana took over on October 1st, 1928, there were exactly 2,512 licences in force in Slovenia, but, says *World-Radio*, the latest figure is 4,246, and since January 1st, 1929, the 5,000 mark has been passed. The number of actual listeners may be four times the number of licences, or about 20,000. Ljubljana is, of course, close to the Italian frontier; the Italian authorities, however, do not issue licences for sets within 30 km. of the frontier.

New Zealand.—LICENCES.—According to *World-Radio*, there are now 42,801 listeners' licences in force, besides 169 transmitting and 1,464 dealers' licences. Approximately three-quarters of the licences are held by residents of the North Island. Among the listeners are 179 blind persons, to whom the privilege of listening is granted without cost. There is now much greater satisfaction among listeners than was the case twelve months ago, and the Radio Broadcasting Company has received many compliments.

RELAYS.—The successful relaying of a recent concert in Wanganui over landlines to (2YA) Wellington, 150 miles away, marked the first relay of any distance in New Zealand, and general interest has been aroused by the announcement that the R.B.C. is to co-operate with the local Radio Society in running a relay station at New Plymouth.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—March 15th. Victorian Railways. Armoured telephone cable. (B.X. 5126.)*

Ballinrobe (Co. Mayo).—March 9th. County Board of Health. Electric lighting installation, Creagh House. Particulars from Mr. T. Flanagan, county surveyor, Courthouse, Castlebar.

Belgium.—ANTWERP.—March 22nd. Municipal Council. Electrical cable and accessories. (B.X. 5124.)*

Bromley.—March 4th. Education Committee. Installation of electric lighting at the Raglan Road Council school. Specifications, &c., from Mr. W. G. Trend, borough electrical engineer, West Street, Bromley.

Canada.—BRITISH COLUMBIA.—Extension of hydro-electric plant at Stave Falls. (A.X. 7529.)*

Cardiff.—March 19th. Electricity Department. E.h.p. and l.p. cables, and one natural draught cooling tower. (See this issue.)

Cheam.—March 7th. Croydon and District Joint Small-pox Hospital Board. Wiring and electric lighting installation at the various sanatorium buildings. Specifications from Mr. G. F. Carter, surveyor to the Board, Town Hall, Croydon. (Deposit £3 3s.)

Dover.—March 4th. Harbour Board. Electrical sundries and electric cables for 12 months. Mr. Rutley Mowll, Registrar, Castle Street (deposit of 2s. 6d. for each schedule).

Dundee.—March 13th. Electricity Department. L.p. cable. (See this issue.)

Edinburgh.—March 25th. Electricity Supply Department. Underground insulated cables, conduits, pavement and road box frames and covers, house-service fuse boxes and fuse-board, electricity supply meters. (February 15th.)

March 15th. One 1,500-kW motor convertor. (February 22nd.)

Fort William.—March 12th. North British Aluminium Co., Ltd. Material required for the electric power and lighting distribution system at the works near Fort William. (February 22nd.)

Holbeach.—March 6th. Board of Guardians. Electric light installation at the Institution. Mr. S. S. Mossop, jun., clerk.

Hull.—March 21st. Electricity Committee. Electrically-driven circulating water pump, motor, motor-starter, &c. (See this issue.)

Lancaster.—March 18th. Electricity Department. Two water-tube boilers (36,000 lb. per hour), with mechanical stokers, economisers, air heaters, steel chimney and fans. (February 22nd.)

Liverpool.—Water Committee. Electrically-driven pumping sets for the Aubrey Street pumping station. (February 22nd.)

London.—CENTRAL ELECTRICITY BOARD.—April 15th. North West England and North Wales Electricity Scheme, 1928. 33,000-V overhead transmission lines. (See this issue.)

METROPOLITAN ASYLUMS BOARD.—March 20th. Installation of automatic telephone system at the North-Western Fever Hospital, Lawn Road, Hampstead. (See this issue.)

Manchester.—March 6th. Electricity Committee. House wiring material for the assisted wiring and hired apparatus schemes. (February 22nd.)

New Zealand.—WELLINGTON.—April 15th. Post and Telegraph Department. Conductor cords. (B.X. 5098.)*

Oldham.—March 11th. Board of Guardians. Electric lamps and fittings. Forms of tender from Mr. F. W. Fletcher, clerk to the Guardians, Union Offices.

Pentre, Rhondda.—March 30th. U.D.C. Electricity Department. A.c. ordinary and prepayment meters, mains and house service material. (See this issue.)

Portsmouth.—Electricity Department. Four electrically-driven vertical circulating pumps. (See this issue.)

Sheffield.—March 14th. Electricity Supply Department. Buildings and civil engineering works and constructional steelwork, transformers, pipework and valves, e.h.p. switchgear, battery shunting locomotive and accesorises. (February 22nd.)

South Africa.—JOHANNESBURG.—March 21st. Town Council. 65,500 porcelain insulators. (B.X. 5114.)* Weatherproof wire. (B.X. 5113.)*

Southend-on-Sea.—March 4th. Electricity Department. 1,200 d.c. house-service electricity meters. (February 22nd.)

Warrington.—March 11th. Electricity and Tramways Committee. Motors and transformers. (February 22nd.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Aberdeen.—Tramways Committee. Accepted. In connection with supply of 12 tramcars:—
Bodies and trucks.—Brush Electrical Engineering Co., Ltd.
Electrical equipment, motors and controllers.—English Electric Co., Ltd.

Bedford.—Electricity Committee. Recommended:—
Interconnecting switchgear (£18,685).—British Thomson-Houston Co., Ltd.

Bournemouth.—Pavilion Committee. Accepted:—
Generator, induction motor, &c., for kinema at pavilion, including fixing and wiring (£198); resistances and flood lighting installation for band platform (£202).—Aish & Co.

Bromley (Kent).—Town Council. Accepted:—
Wiring 91 houses for electric light (£532).—A. Sutton.

Croydon.—Electricity Committee. Recommended:—
One 1,000-, two 750-, two 500-, and two 400-kVA oil-cooled transformers (£2,706).—British Electric Transformer Co., Ltd.

Glasgow.—Housing Committee. Recommended :—
Electrical installations at 318 houses (Haghill estate) (£1,241), and at 174 houses (Saracen estate) (£716).—Mr. R. J. M'Intyre.
Electricity Committee. Recommended :—
Sub-station switchgear.—A. Reyrolle & Co., Ltd.
Four 400-kVA transformers.—Ferranti, Ltd.
Six 200-kVA ditto.—Bruce, Peebles & Co., Ltd.
Tramways Committee. Accepted :—
Ten cable groove rings for subway power station (£418).—Fullerton, Hodgart & Barclay, Ltd.
Manganese steel rails.—Edgar Allen & Co., Ltd.
28-in. copper bonds.—British Insulated Cables, Ltd.
Improvements Committee. Recommended :—
Passenger lift at Glasgow Cross buildings (£1,173).—Waygood, Otis, Ltd. Goods lift (£411).—A. & P. Steven, Ltd.

Government Contracts.—The following Government contracts were placed during January, 1929 :—

Admiralty (Contract and Purchase Department).
Accumulators and cells.—Oldham & Sons, Ltd.; Hart Accumulator Co., Ltd.; D.P. Battery Co., Ltd.; Chloride Electrical Storage Co., Ltd.; Fuller Accumulator Co., Ltd.
Electric bells.—Hawkers, Ltd.; Engineering and Lighting Equipment Co., Ltd.; D. H. Bonnella and Sons.
Condenser boxes.—Engineering & Lighting Equipment Co., Ltd.; L. Weekes (Luton), Ltd.
Cable clips.—Aston Chain & Hook Co., Ltd.; Freckleton and Co.; Hawkers, Ltd.; R. & F. Keates.
Electric cable.—W. T. Henley's Telegraph Works Co., Ltd.; General Electric Co., Ltd.; W. T. Glover and Co., Ltd.; Connollys (Blackley), Ltd.
Inert cells.—General Electric Co., Ltd.
Electric cranes.—H. Morris, Ltd.; Sir Wm. Arrol & Co., Ltd.; Vaughan Crane Co., Ltd.
Electric heating elements.—Credenda Conduits Co., Ltd.
Table fans and spares.—General Electric Co., Ltd.; Veritys, Ltd.
Lampholders.—Rainsford & Lynes, Ltd.; Sperryn & Co.; W. McGeoch & Co., Ltd.; General Electric Co., Ltd.; Edison Swan Electric Co., Ltd.
Incandescent electric lamps.—General Electric Co., Ltd.; Siemens Electric Lamps & Supplies, Ltd.; Metro-Vick Supplies, Ltd.; Edison Swan Electric Co., Ltd.; British Thomson-Houston Co., Ltd.
Electric motor.—Laurence Scott & Co., Ltd.
Switchboards.—Park Royal Engineering Co., Ltd.
Insulating tape.—Ioco Rubber & Waterproofing Co., Ltd.
Testing sets.—Everett, Edgcumbe & Co., Ltd.
W./t. tuners and amplifiers.—Radio Instruments, Ltd.
Aerial wire.—Thos. Bolton & Sons, Ltd.
Copper wire.—General Electric Co., Ltd.; Concordia Electric Wire Co., Ltd.; Ward & Goldstone, Ltd.; Kent Bros. Electric Wire Co., Ltd.; E. H. Phillips, Ltd.
Tin wire.—C. Clifford & Son, Ltd.
X-ray tubes.—C. Andrews; Philips Lamps, Ltd.; Victor X-Ray Corporation, Ltd.

War Office.
Boxes for telephone sets.—H. W. Sullivan, Ltd.
Electric cable.—Hackbridge Cable Co., Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.
Generating sets.—Blackstone & Co., Ltd.
Motor alternator.—Electric Construction Co., Ltd.

Air Ministry.
Alternator sets (Cranwell).—Electric Construction Co., Ltd.
Cable.—London Electric Wire Co. & Smiths, Ltd.
Receivers and rheostats.—C. A. Carter & Co.

Post Office.
Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.; Ericsson Telephones, Ltd.; General Electric Co., Ltd.; International Electric Co., Ltd.; Telephone Mfg. Co., Ltd.
Wireless apparatus.—Marconi's Wireless Telegraph Co., Ltd.; Standard Telephones & Cables, Ltd.
Cable.—British Insulated Cables, Ltd.; Connollys (Blackley), Ltd.; Enfield Cable Works, Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Macintosh Cable Co., Ltd.; Pirelli-General Cables, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones and Cables, Ltd.; Union Cable Co., Ltd.
Joint-box castings.—Jones & Attwood, Ltd.; United Steel Co., Ltd. (T. Butlin & Co. Branch).
Loading coils.—Standard Telephones & Cables, Ltd.
Steel masts.—W. Baird & Son, Ltd.
Telegraph poles.—J. Kennedy & Co., Ltd.
Battery (Glasgow Central Telephone Exchange).—Tudor Accumulator Co., Ltd.
Enlargement of battery (Canterbury Telephone Repeater Station).—Chloride Electrical Storage Co., Ltd.
Manufacture, supply, drawing-in and jointing cable.—Anglo-Irish (Douglas-Port Erin section) : British Insulated Cables, Ltd.; Plymouth-Torquay : Johnson and Phillips, Ltd.
Electric lift (Oxford station sorting office).—R. J. Shaw and Co., Ltd.
Electric lighting (Newcastle-on-Tyne Central Automatic Telephone Exchange).—Devereux, Moodie & Co., Ltd.
Electric overhead crane (Birmingham Post Office Stores Depôt).—H. Morris, Ltd.
Short-wave radio-telephony transmitter (No. 1 Rugby radio station).—Standard Telephones & Cables, Ltd.
Telephone exchange equipment.—Hanley multi-exchange area, Newcastle-under-Lyme, Burslem, Stoke, Longton, and Bexhill-on-Sea : General Electric Co., Ltd. Sub-contractors : Crompton Parkinson, Ltd., for charging and ringing machines; D.P. Battery Co., Ltd., for batteries. Hazel Grove : Siemens Bros. and Co., Ltd. Sub-contractors : English Electric Co., Ltd., for charging machine; Crompton Parkinson, Ltd., for ringing machine; Premier Accumulator Co., Ltd., for batteries. Davidson Mains (Edinburgh multi-exchange area) : Siemens Bros. & Co., Ltd. Newcastle Central : Standard Telephones & Cables, Ltd. Sub-contractors : Electric Construction Co., Ltd., for charging machines; Chloride Electrical Storage Co., Ltd., for batteries. Felling, Jarrow, Benton, Whickham, Kenton, Newcastle East, Gosforth, Newcastle West : Standard Telephones and Cables, Ltd. Sub-contractors for Newcastle East, Gosforth, and Newcastle West : Electric Construction Co., Ltd., for charging machines; Crompton Parkinson, Ltd., for ringing machines; Hart Accumulator Co., Ltd., for batteries. Gateshead, Wallsend, Low Fell : Standard Telephones & Cables, Ltd. Sub-contractors for Gateshead, Wallsend, and Low Fell : Electric Construction Co., Ltd., for charging machines; Crompton Parkinson, Ltd., for ringing machines; D.P. Battery Co., Ltd., for batteries. Farnborough : Automatic Telephone Mfg. Co., Ltd.

Crown Agents for the Colonies.
Accumulator.—Chloride Electrical Storage Co., Ltd.
Cables.—Brown, Lennox & Co., Ltd.; W. T. Glover and Co., Ltd.
Generating sets.—General Electric Co., Ltd.; Norris, Henty & Gardners, Ltd.
Switchgear.—Taylor & Challen, Ltd.
Telegraph apparatus.—Creed & Co., Ltd.
Telegraph ironwork.—Bullers, Ltd.
Telephone equipment.—Ericsson Telephones, Ltd.
Train-lighting equipment.—J. Stone & Co., Ltd.
Transformer kiosks.—Metropolitan-Vickers Electrical Export Co., Ltd.
Transformers.—British Thomson-Houston Co., Ltd.
X-ray apparatus.—Schall & Sons.

Grimsby.—Electricity Committee. Recommended :—
Steam and water pipe work in connection with plant extensions (£6,729).—John Thompson, Ltd.

London.—Metropolitan Water Board.—Recommended :—
Three sets vertical high compression heavy oil engines and reciprocating pumps at Woodford pumping station (£20,382).—Lilleshall Co., Ltd.
Two sets of high compression heavy fuel oil engines at Honor Oak pumping station (£3,947).—Ruston and Hornsby, Ltd.
Two sets centrifugal pumps at Honor Oak (£1,186).—Mirrlees-Watson Co., Ltd.
Copper wire (£170).—W. T. Henley's Telegraph Works Co., Ltd.

London County Council.—Housing Committee. Electric lighting, cooking and heating installation in the tenements on the Ossulton Estate, St. Pancras.

C. Luidop & Son	£1,393
Alexander Hawkins & Sons. (Recommended.)	1,739
G. V. Francis	1,794
Hall's Longitudinal Lighting Co., Ltd.	1,835
Electricity Services, Ltd.	1,960
A. V. Gifkins & Co., Ltd.	1,999
Alpha Manufacturing and Electrical Co., Ltd. ...	2,150
E. Dyne	2,246
Eons Electrical Co.	2,348
Tredegars (1923), Ltd.	2,354
Harland & Wolff, Ltd.	2,358
W. Davey	2,362
Engineering Works (Electrical & General), Ltd.	2,367
Joseph Vigor	2,498
A. Higginbotham & Sons	2,530
Aldwych Electrical, Ltd.	2,593
H. H. Bucklar	2,701
E. Wight & Co.	2,858
Fred Hodgson & Co., Ltd.	2,879
J. Nicoll	3,684
General Electrical Maintenance Co.	4,219

The chief engineer's comparable estimate is £1,790.

Hornsey.—Estates Committee. Recommended :—
Installation of electric clocks at Town Hall.—Synchronome Co., Ltd.

Morecambe.—Fire Brigade Committee. Accepted :—
Installation of fire alarm system (£175).—W. B. Hodgson and Son.

Preston.—Electricity Committee. Recommended :—
E.h.p. switchgear for Preston and Blackpool transmission line sub-station (£14,020).—English Electric Co., Ltd.

Southend-on-Sea.—Town Council. Accepted :—
Alterations and extensions of the electric lighting at the Cliffs Bandstand, &c. (£327).—F. P. Richard & Co.

Staines.—Board of Guardians. Accepted :—
For wiring, &c., a portion of the Infirmary, and also the Girls' Home (£261).—Cooksey & Son.

Tunbridge Wells.—Accepted :—
Installing electric light at the Parish Church and Memorial Hall, Brinchley.—H. Featherstone.

West Ham.—Education Committee. Accepted :—
Installing electric light at South Hallsville School (£545).—Harland & Wolff, Ltd.

Forthcoming Events.

"Daily Mail" Ideal Home Exhibition.—Tuesday, February 26th, to Saturday, March 23rd. Olympia, W.

Finsbury Technical College Old Students' Association.—Friday, March 1st. Trocadero Restaurant. 6.30 for 7 p.m. Annual dinner.

Batti-Wallahs' Society.—Friday, March 1st. Hotel Cecil. 7 p.m. Annual dinner and dance.

Junior Institution of Engineers.—Friday, March 1st. 39, Victoria Street, S.W. 7.30 p.m. "The Control of Electric Lifts." Mr. L. S. Atkinson.

Electrical Power Engineers' Association (London Western Section).—Saturday, March 2nd. St. Ermine's Hotel, Westminster, S.W. 6.30 for 7 p.m. Annual dinner.

Royal Institution of Great Britain.—Saturdays, March 2nd and 9th. 21, Albemarle Street, W. 3 p.m. "Molecular Motions in Rarefied Gases." Sir Ernest Rutherford.

London Association of Foremen Engineers.—Saturday, March 2nd. Cannon Street Hotel. 6 p.m. Anniversary festival.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, March 4th. Institution, London, W.C.2. 7 p.m. "Variable-speed A.C. Motors." Mr. L. J. Hunt.

(Meter and Instrument Section).—Friday, March 1st. Institution, London, W.C. 7 p.m. "The Rotor Bearings of Electricity Meters." Mr. W. Lawson.

(Wireless Section).—Wednesday, March 6th. Institution, London, W.C.2. 6 p.m. "Single Wave-length Working." Captain P. P. Eckersley and Mr. A. B. Howe.

(Irish Centre (Dublin)).—Thursday, March 7th. Trinity College, Dublin. 7.45 p.m. "Picture Telegraphy." Mr E. S. Ritter.

(North-Western Centre).—Tuesday, March 5th. Engineers' Club, Manchester. 7 p.m. "An Introduction to Researches on Circuit Breaking." Messrs. E. B. Wedmore, W. B. Whitney, and C. E. R. Bruce. (Electrical Research Association Report.)

(South-Midland Centre).—Monday, March 4th. University, Birmingham. 7 p.m. "The Anticipation of Demand and the Economic Selection, Provision, and Lay-out of Plant." Capt. J. M. Donaldson and Mr. J. G. Hines.

(North-Eastern Students' Section).—Friday, March 8th. Armstrong College, Newcastle-on-Tyne. 7.15 p.m. Informal discussion. 'That the Electrical Industry is Moribund." Mr. V. A. H. Clements.

(London Students' Section).—Tuesday, March 5th. "Les Gobelins" Restaurant, Regent Street, W. 7.15 p.m. for 7.30 p.m. Annual dinner.

(Scottish Centre).—Friday, March 8th. Cowdray Hall, Aberdeen. 8 p.m. Faraday Lecture: "How Electricity Does Things." Mr. Ll. B. Atkinson.

Electrical Society of Glasgow.—Tuesday, March 5th. Reid's Smoke Room, Glasgow. 7.30 p.m. "Brevities." The president and others.

Association of Supervising Electrical Engineers.—Tuesday, March 5th. Junior Institution of Engineers, 39, Victoria Street, S.W. 7.15 p.m. "Television." Mr. H. A. Hankey.

Faraday House Old Students' Association.—Tuesday, March 5th. Victoria Halls, Southampton Row, W.C. 8 p.m. Dance.

Physical Society.—Friday, March 8th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following :—

BEAUTY massage vibrators.
GLAMOR British tumbler switches.
AUTO-SAFE electric iron.
VICMA cables.

Notes.

Mining Electrical Engineers' Dinner.

The South Wales branch of the Association of Mining Electrical Engineers held its annual dinner at Cardiff on Saturday last, the branch chairman, Mr. T. S. Thomas, presiding. Submitting the toast, "The Mining Industry," the chairman said it was a pleasure to read of collieries opening up and not, as had become the custom, closing down. H.R.H. the Prince of Wales had emphasised the part of the salesmen. They were usually a keen and active body of men and he had no doubt that, given a period of peace and goodwill in the industry and markets free from reparation coal, the salesman would acquit himself as efficiently as the British engineer.

Replying, Mr. D. Farr Davies, chairman of the South Wales branch of the Colliery Managers' Association, said he was proud to say there was a spurt in the industry, but the coal trade had been very sick. It would not be wise to be too optimistic; better to face the future with courage and determination that they, as engineers, would leave no stone unturned to make the industry as prosperous as it had ever been in the past.

"The Association of Mining Electrical Engineers" was submitted by Capt. Carey, H.M. Divisional Inspector of Mines, who referred to Welsh coal as the finest in the world; yet, he said, they found themselves in the "slough of despond." That should not be. If their American friends had such a product, they would set up a "Woolworth's" store in every part of the world and sell it in big lots as well as little. Few people realised that it was cheaper in the long run to buy a more expensive coal, when, ton for ton, so much more could be got out of it, not only in heat units, but in many indirect ways.

In reply, Mr. F. Anslow, national president of the Association of Mining Electrical Engineers, referred to the mutual admiration and sympathy which they had always fostered between, not only the colliery electrical engineers and the manufacturers, but particularly with the Mines Department and the Inspectors, who had been of great service to the Association. He also referred to the need for improved educational facilities for those wishing to pass the Association's examinations. The Council felt there was a great gap in the system between the time of leaving the elementary school and taking, say, a university course.

Responding to the toast of "Kindred Associations," which was ably proposed by Mr. Idris Jones, Prof. Knox, president of the South Wales Institute of Engineers, said a Government committee had been appointed a short time ago to enquire into the question of the relationship between education and industry. An excellent report had been made by that committee and if the scheme suggested were put into operation it would overcome the difficulty mentioned by the president.

Mr. W. J. Bache, chairman of the Western Centre, Institution of Electrical Engineers, said the mining industry was a vast and complicated industry which required the co-operation of all engineers. In connection with the activities of the Central Electricity Board he was astonished to learn of the tremendous amount of work which had been done by colliery engineers in South Wales.

Major E. Ivor David referred to the certification of various grades of colliery officials. The Mines Department had asked for assistance in the matter. As regards the mining electrical engineer that assistance would be given by his Association, and they would have to back it up with all the power they could.

The toast "Our Guests" was given by Major W. Roberts, and replied to by Mr. T. Allan Johnson (past president, South Wales Institute of Engineers).

Electro-Harmonic Societies.

Members of the Manchester Electro-Harmonic Society will be the guests of the Liverpool Electro-Harmonic Society at the hot-pot supper and concert on March 22nd at the St. George's Restaurant, Liverpool.

Electricity in French Rural Districts.

Strong efforts are being made in France to extend the use of electricity in agricultural districts, and important credits have been voted for this purpose by the Government. The Inspector-General of Rural Development has recommended in a recent report that electrically driven apparatus for agricultural purposes in France should be standardised in order to avoid all possibility of complication to individuals who are unacquainted with even rudimentary mechanical principles, and that such apparatus should be limited to 1 h.p. for appliances hitherto driven by hand, to 3 h.p. for similar apparatus employed on more important undertakings, and to 5 h.p. for special appliances requiring greater power, such as saws, hoists, presses, and pumps. While strength of design must be retained, simplicity of operation and low price are also vital. The actual efficiency of the apparatus is almost of secondary importance, for very few agricultural appliances are employed for long periods, and the excellent finish given to industrial plant is not necessary.

Rotary Snow Ploughs in Sweden.

Two electrically-driven rotary snow ploughs have recently been installed on the Swedish State Railways to clear the lines of snow which, in places, is occasionally several metres deep. The *Révue Générale des Chemins de Fer* states that each is mounted on the front of a coach, and consists of a turbine wheel three metres in diameter rotated at 125 r.p.m. by a single-phase motor (similar to those employed on Swedish electric locomotives), which develops 565 h.p. continuously, and double that power momentarily when a deep bank of snow has to be cleared. The coach, however, has no propelling motor, and is pushed along the line to be cleared by an electric locomotive controlled from the snow wagon. The turbine wheel is surrounded by a circular case provided with an upper funnel through which the snow is thrown to the sides of the track, while a hinged door operated from the cabin allows the angle of throw to be varied as desired.

Appointments Vacant.

Personal technical assistant and boiler house charge engineer for the Hull Corporation Electricity Department. Storekeeper for the Hongkong Electricity Co., Ltd. Shift charge engineer for the United Alkali Co., Ltd., Widnes. Switchboard attendant (£241) for the Norwich Corporation Electricity Department. (See our advertisement pages to-day.)

The A.S.E.E. Dinner.

The annual dinner of the Association of Supervising Electrical Engineers was held at the Hotel Cecil, London, on Saturday last, the President, Mr. S. B. Donkin, M.Inst.C.E., &c., occupying the chair. After the honouring of the loyal toast, the health of "Our Guests" was proposed by Mr. A. H. Dykes (past-president), who considered that the presence of so many distinguished men proved that the Association held an important position in the industry. Referring to the presence of representatives of the leading engineering institutions, he said that he had always thought it regrettable that the younger branches should have broken away from the Institution of Civil Engineers. The speaker looked upon the supervising electrical engineers as liaison officers between the workers and the management.

In responding, Sir Brodie Henderson (President of the Institution of Civil Engineers), said that he had always had a great respect for those who entered the electrical branch of civil engineering. The electrical industry's progress was a thing to wonder at, and the world was becoming more and more dependent upon electrical engineers. The end of this progress was by no means in sight. Electricity was so essential to every citizen that it needed no advertisement—it advertised itself.

Sir William Noble (late chief engineer to the General Post Office), who also replied, did not agree that one large engineering institution was practicable. Even the Post Office engineers found that they had to form a separate institute in order to give proper attention to telegraph and telephone developments.

Lt.-Col. K. Edgcumbe (President of the Institution of Electrical Engineers), proposing the toast of "The Association," said that the I.E.E. and the A.S.E.E. had a great deal in common. He felt that no new associations should be formed if it could be avoided, but he was sure that no pre-existing body could have carried out the work of the Association. There had recently been a discussion in the technical Press upon the question of whether studying for one's job was worth while. He had no doubt that it was, but studying by itself could not produce something from nothing. The Association was a trade union, but while, generally speaking, trade unions tended to level downwards, the opposite was the case with the A.S.E.E.

Mr. Donkin, in reply, said that the Association was now 15 years old, and had matured. In spite of the qualifications required of candidates, the membership was increasing at the rate of about 10 per cent. per annum. They believed in proper remuneration for their work—and so did the Association of Consulting Engineers, of which he was a member. Education was an important part of their activities, taking the form of lectures, their journal *Contact*, works visits, and a debating society. Some proof of the success of this work was the good attendances. The Association was represented on the I.E.E. Wiring Rules Committee and the B.E.S.A. Conduits Committee, and it had been asked to nominate a member to the B.E.S.A. Accessories Committee. Mr. Donkin also referred to the Association's apprenticeship scheme and to the Employment Board. The latter, he said, had found work for 500 men in 2½ years. In conclusion, he paid a tribute to the officers of the Association:—Mr. L. W. Medcalfe (chairman), Mr. B. C. Garman (vice-chairman), Mr. E. E. Gammon (hon. treasurer), and Mr. A. Brammer (general secretary). Mr. Medcalfe also responded to the toast, and said that with salesmanship so much to the fore it should be remembered that electrical salesmen should be technically-trained men, able to deal promptly with the problems raised by customers who knew what they wanted. The works, too, should back up the salesmen with articles of good quality and with satisfactory delivery. He referred with regret to the absence, through ill-health of Mr. W. J. Revell, to whose past activities the Association owed a great deal.

E.A.W. Activities.

On February 7th a large party of members of the Electrical Association for Women visited the Soho School of Cookery, when Miss Mabel Collins, the principal, gave a lecture-demonstration on a "five-course dinner."

The second evening lecture of the E.A.W. was given at the E.L.M.A. Lighting Service Bureau (London) by Mr. A. de H. Donisthorpe, of the General Electric Company, on the history of wireless transmission and reception.

On February 19th many members availed themselves of the invitation to visit the showrooms of the Singer Sewing Machine Company.

The British Thomson-Houston Co., Ltd., has tendered an invitation to members of the Association to visit the Ideal Home Exhibition on March 13th, and the Hotpoint Electric Appliance Co., Ltd., is inviting the party to luncheon and tea.

On January 28th the Birmingham and Midlands Branch visited the offices, electric canteen and control house of the Shropshire, Worcestershire and Staffordshire Electric Power Co. In a speech Mr. Legge showed how the E.A.W. could help to further the cause of "Electricity and more electricity."

A mid-Gloucestershire branch of the Association was inaugurated at Gloucester recently. The first president of the branch is the Countess of Berkeley.

The first meeting of the Bristol Branch will be held on March 5th. Lady Augusta Inskip will preside, and the chief speakers will be Miss C. Haslett, director, E.A.W., Miss M. Partridge, B.Sc., and Mr. J. H. Inskip.

Motor Fuel Production at Electricity Stations.

The Société des Automobiles Bovy, of Brussels, in conjunction with the Société des Centrales des Flandres, entered in a recent trial in France and Belgium a 30-cwt. motor lorry, the engine of which consumed fuel produced at the electricity station at Langerbrugge, Belgium. In order to utilise the whole of the heat value of the coal used for steam raising at the station rotary low-temperature carbonising furnaces have been installed between the stoking apparatus and furnaces of the boilers. The carbonised coal, in the form of a semi-coke, is fed to the furnace proper, to which, if necessary to assist combustion, part of the gases obtained by the carbonisation process can also be supplied. In addition to the semi-coke and gas, about 13 gallons of tar is derived per ton of raw coal, an excellent quality of motor fuel being obtained from the tar by the Kling cracking process. During the trial the vehicle, which (with its load) weighed 3 tons 9 cwt., maintained an average speed of nearly 20 m.p.h. on a consumption of approximately 13½ m.p.g.

Fultograph Photo-telegraphy.

Satisfactory results are claimed to have been obtained with a new method adopted by the Fultograph Gesellschaft for the transmission of still pictures. The altered system, which allows the immediate transmission of topical pictures, was first used, says *The Times*, on February 21st, by the Königswusterhausen station. Hitherto the Fulton system has necessitated the conversion of the picture at the transmitting end into a specially prepared foil, covered in varying degrees with insulating material. The new method replaces the metal point used in connection with the prepared foil to produce the electrical oscillations by a very fine ray of light, which plays upon a rotating glass cylinder, on which a photographic negative is placed. A Kalium cell inside the cylinder converts the light impulses into the required electrical impulses. Pictures have been transmitted on the Fulton system from the German national station at Königswusterhausen since November 20th last. The hours of transmission are from 9.45 to 10.15 p.m. (Greenwich mean time) on Tuesdays and Fridays, and 12.45 to 1.15 p.m. on the other week-days and Sundays.

A Coalfield Survey.

A publication of the Department of Scientific and Industrial Research, "Physical and Chemical Survey of the National Coal Resources, No. 13" (H.M. Stationery Office, 3s. net), contains a report on the Parkgate seam of the South Yorkshire area of the Yorkshire, Nottinghamshire and Derbyshire coalfield. It gives the results of a comprehensive and detailed examination, from floor to roof, of sixteen complete sections of the seam taken at different points well distributed over the

area. Appendices deal with general considerations of the uses of Parkgate coal for various purposes and with a comparison of the value of Parkgate and Barnsley "hards" for use as a locomotive fuel. The report includes a map of the South Yorkshire area, diagrams of the sections of the seam used for this investigation, and photographs of typical cokes from the Gray-King assay.

A Turbo-Electric Liner.

Acceptance trials took place on February 19th of the P. & O. liner *Viceroy of India*, built by Alexander Stephen & Sons, Ltd., the first large passenger liner in this country to be fitted with turbo-electric propelling machinery. In addition, the vessel is the first ship of notable size to have single-berth first-class rooms. The whole of the electrical equipment has been manufactured by the British Thomson-Houston Co., Ltd.

An International Telephone Directory.

In view of the rapid growth of international telephony, it has been arranged to publish shortly in Great Britain and on the Continent the first International Telephone Directory. This will be printed in English, French and German, and subscribers' entries will be classified under countries, towns, and trades in alphabetical order. It will thus be possible according to Mr. C. Ramussen, the London representative of the Copenhagen firm responsible for its production, to find out in a few seconds the principal firms engaged in a particular line of business in any one country at home or abroad, with their addresses and telephone numbers. The directory will include the principal cities in nearly thirty European States, and negotiations are proceding for the inclusion also of Canada and the United States.

A Japanese Automatic Convertor Station.

Some years ago the municipal authorities of Tokio, Japan, decided to ease their traffic problem by building an underground railway, the first double-track section (about 1¼ mile) of which was opened about a year ago. In the construction work due regard had to be paid to earthquakes; therefore the supporting structure of the tunnels consists of steel frames joined together in a longitudinal direction. The cars conform to the usual design of those employed for rapid-transit railways, being equipped with twin-bogey under frames and bodies with three sliding doors on each side. Electricity is collected from a third top-contact rail fed from a sub-station in the immediate vicinity of the Ueno underground station, Tokio, which will house five rotary convertor sets. At present two machines only are installed with apparatus for effecting the automatic starting of the convertors. The two incoming 11-kV lines are three-phase, and the entire h.p. equipment is so designed that it will be suitable, without modification, for a working pressure of 22 kV when the system is eventually extended. Four feeders equipped with over-current air circuit-breakers feed the railway, the machines being sufficiently protected by their own high-speed breakers, but each railway feeder is equipped with over-voltage arrestors: each of the latter consists of several cells (the number determined by the value of the working voltage) housed in a common case, each cell having two aluminium plates immersed in an electrolyte; the plates are covered with a film of aluminium-hydroxide.

The two rotary convertors installed are designed for a continuous output of 1,000 kW at a normal working voltage of 600 volts, 750 r.p.m., 50 cycles. They can be overloaded to 1,500 kW for two hours and to 3,000 kW for one minute. The machines are provided with shaft-oscillating gear and a commutator protective device which, in conjunction with the high-speed circuit breakers, prevents arcing between the brushes on the occurrence of heavy short-circuits. The slip-rings are totally enclosed, and brush-dust is extracted by a fan under the slip-rings.

Although no marked economy in service costs is effected thereby, it was decided to include automatic gear for starting the convertors. The plant, which was supplied by the A.E.G. Co., of Berlin, has now been in operation for about twelve months, and has proved so satisfactory that the Japanese Railway Authorities have decided to carry out certain extensions in which similar means of control will be adopted.

Institution Notes.

Institution of Electrical Engineers.

INFORMAL MEETING.—At the informal meeting on February 18th, Mr. C. F. Mounsdon was in the chair when Mr. R. L. Morrison opened a discussion on "Modern High-power Rectifiers: their Development and Use." He observed that the optimism with which he had spoken of the future of that apparatus when he addressed a meeting on the subject a few years back had been thoroughly justified, for they were being generally adopted throughout the world. Simultaneously they had increased in size, so that where they were formerly in sets of hundreds of kW, now they were of thousands of kW. Their progress he attributed chiefly to the seal of mercury which enabled a valve to be left for periods as long as six months without appreciable loss of vacuum; there was no foundation for the fear that mercury vapour poisoning was possible, there was not a single instance on record. He gave some remarkable figures of their efficiencies, especially at higher voltages, and claimed that when coversion was required, the high-power rectifier was unchallenged because it was stationary, silent and vibrationless; maintenance was negligible and service reliable.

Mr. A. M. Browne preferred the glass bulb rectifier which, though limited to some 130-kW capacity, could be multiplied indefinitely with the responsibility limited. It had the advantage that no pump was needed to maintain vacuum.

Mr. T. F. Lister said the reason rectifiers had made more headway abroad than in England was because our conservatism liked to see something moving, and had a sneaking affection for rotary plant. When the expense was justified it was possible to adopt 12-phase rectification and eliminate all telephone and wireless interference.

Messrs. R. Blennerhassett, J. Eck, W. A. Erlebach, W. Lang, M.M. Macmaster, J. F. Shipley, S. A. Stevens, E. O. Taylor, and H. H. Taylour also spoke.

MERSEY AND NORTH WALES (LIVERPOOL) CENTRE.—The opportunity was taken on the occasion of the annual Faraday lecture at Liverpool to present the Coopers Hill War Memorial prize, consisting of a bronze medal, certificate, and money award, to Mr. W. Phœnix, of the Warrington Corporation Electricity Department, for a paper on electricity in agriculture. The presentation was made by Mr. S. E. Britton, chairman of the Centre.

Institution of Mechanical Engineers.

The annual report of the Council of the Institution of Mechanical Engineers for the year 1928 shows a total membership at December 31st of 10,466, representing an increase of 210. The revenue and expenditure account for the year shows an expenditure of £28,760, leaving a surplus of £3,181.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mrs. ALLEN, writing from 114, East Dulwich Grove, S.E.22, asks us to express her thanks to all the friends of her late husband, Mr. A. H. Allen, for their letters of sympathy.

Mr. W. E. WOODESON, general manager, and Mr. W. Q. HENRIQUES, in charge of the London office, have been elected directors of Messrs. Clarke, Chapman & Co., Ltd.

Sir JAMES DONALD, C.S.I., C.I.E., has joined the Board of the Calcutta Electric Supply Corporation, Ltd., in the vacancy caused by the death of the late Mr. P. V. Luke, C.I.E.

Mr. J. W. SIMPSON, formerly town clerk of Thornaby-on-Tees, has been appointed secretary to the Incorporated Municipal Electrical Association.

Mr. PERCY HUGGINS, A.M.I.E.E., has resigned the post of departmental manager of the Electrical Engineering Section of Messrs. Royce, Ltd., on his appointment to the technical staff of the Lancashire Dynamo and Motor Co., Ltd.

Mr. W. P. HICKS has left the technical sales department of Crompton Parkinson, Ltd., to join the staff of the Haviland Engineering Co., Alloa. His colleagues have presented him with a silver cigarette case.

Sunderland Corporation Tramways Committee has recommended the Town Council to appoint Mr. C. A. HOPKINS, general manager of Wigan Corporation tramways, motor 'buses and trolley undertaking, as engineer and general manager of Sunderland Corporation tramways, at £800 per annum.

Mr. Frank Buckley, general manager of the Bury Municipal Tramways, who is leaving to become general manager to the Norwich City Tramways Co., has been presented with a gold hunter watch by the officials and staff of the Tramway Department; with a spirit tantalus by members of the Lancashire and Cheshire Tramways and Transport Managers' Association; and with a case of cutlery and other gifts by the Bury Corporation officials.

Mr. Lennox B. Lee, chairman of the Calico Printers' Association, has been nominated president-elect of the Federation of British Industries.

Sir Hugo Hirst, Bt., and Sir Ernest Clark, two members of the British Economic Mission to Australia, arrived at Southampton on Friday last week on board the *Tamaroa*. Sir Hugo intends to lecture in the provinces shortly, the first lecture being due for delivery before the Federation of British Industries early this month.

The Croydon Corporation has been recommended to increase the salary of Mr. A. C. Cramb, borough electrical engineer, from £1,500 to £1,600 per annum.

The many friends of Mr. F. H. Nalder, M.I.E.E., managing director of Nalder Bros. & Thompson, Ltd., will learn with regret that he has been seriously ill, and has been confined to the house for over two months. We are glad to learn that he is making satisfactory progress, and hope that he will soon be restored to good health.

The Hull Corporation Electricity Committee has recommended that Mr. C. I. Shuttleworth, A.M.I.E.E., Deputy City Electrical Engineer, be paid the difference between his salary as deputy engineer and the full salary paid to Major Bell, M.I.E.E., for the four months during which he was in charge of the undertaking before Mr. J. N. Waite, M.I.E.E., took up his appointment in Hull. It was also unanimously resolved that a letter of high appreciation of the services of Mr. Shuttleworth should accompany the payment.

By the death of his father, Lord Barnby, Col. the Hon. Francis Vernon Willey, who is a member of the Central Electricity Board and was president of the Federation of British Industries in 1925-26, assumes the peerage.

Obituary.—Mr. C. W. V. Schaefer.—We briefly announced in our last issue the death of Mr. C. W. V. Schaefer, M.I.E.E. Mr. Schaefer entered the service of the Eastern Telegraph Company as a probationer at Malta in September, 1884, his father being in the service of the company at that station. In 1887, Mr. Schaefer was transferred to Gibraltar, remaining there until 1890, when he joined the electrical staff of the cable-ship *Electra*. He subsequently served afloat in the cable-ships *Chiltern*, *Great Northern*, the old *Mirror*, *Amber*, and the *John Pender*, in which ship he took over electrical charge from Mr. F. Ryan in February, 1902. Mr. Schaefer left the cableship *John Pender* upon his appointment to the H.O. Staff in April, 1906, and was promoted to the position of electrician-in-chief upon Mr. F. Ryan's retirement in March, 1923. It was a coincidence that Mr. Schaefer should have relieved Mr. Ryan both as chief electrician afloat and electrician-in-chief of the associated companies. The long practical experience in cable construction, laying and repairing, gained by Mr. Schaefer especially fitted him for his position as head of the department responsible for this work, and he was a recognised authority on cable engineering in all its branches. The benefit of this experience, too, is reflected by the utility of his various tests for the localisation of breaks and faults in submarine cables, the well-known "Schaefer" break test being practically universally adopted by the cable community at large, and he leaves behind most valuable data in the field of cable engineering. During the time Mr. Schaefer was electrician-in-chief of the Associated Companies the system of working the companies' cables was entirely altered by the introduction of the regenerator on all the principal routes. The change-over of the system was difficult and required much detailed organisation to ensure that the normal working of the cables was in no way jeopardised. He took a large share of this work on his shoulders, the scheme only being completed shortly before his death. Ability of a marked order, combined with an equable temperament, endeared him to all those who had the privilege to serve under him.

Mr. E. Raymond Barker.—We regret to record the death, which occurred on February 21st, at a nursing home in London, of Mr. Edward Raymond-Barker, M.I.E.E. He had been ill for many years. Mr. Raymond-Barker, who was born in 1857, entered the School of Submarine Telegraphy in London in 1875, and held appointments thereafter with the Eastern and Brazilian Submarine Telegraph Companies. He became first assistant chief electrician at the submarine cable works of the India Rubber, Gutta Percha and Telegraph Works Co., Ltd., at Silvertown, in 1891, and remained with that company until his retirement in 1912. He saw service in many submarine cable-laying expeditions, invented a calculator board for cable ships and the multi-tone transmitter, wrote many articles in the Electrical Review, and published various books and pamphlets regarding the apparatus and methods which were so closely related to his submarine cable career.

Mr. R. E. Gallaher.—Mr. Raphael Eccleton Gallaher, president of the New York Insulated Wire Company, died in New York, on February 10th. He was 78 years of age and was a pioneer in the wire and cable industry of the United States. In 1884 he organised the above company, which is now a member of the Wire and Cable Section of the National Electrical Manufacturers' Association. He held the position of secretary of his company from the time it was organised until 1927, when he became president.

Lady Lodge.—We believe that in expressing our deep sympathy with Sir Oliver Lodge, F.R.S., on the death of Lady Lodge, which occurred on February 20th, at the age of 78 years, we are also voicing the feelings of the whole electrical and scientific world.

Mr. C. F. Wilkins.—We regret to record the death, which occurred on February 21st, of Mr. Charles Frederick Caxton Wilkins, managing director of Muirhead & Co., Ltd., Elmers End, Beckenham. Mr. Wilkins, who was 57 years of age, passed away at a nursing home after an operation.

Mr. J. Dugdill.—We regret to learn of the death at the age of 67 years, of Mr. John Dugdill, of John Dugdill & Co., electrical fittings manufacturers, of Hazel Grove, near Stockport.

Mr. R. B. Yeardsley.—The death is announced of Mr. Robert B. Yeardsley, who had for some time been on the electricity staff of the Birkenhead Corporation.

Mr. F. Hill.—We regret to learn that Mr. F. Hill, chief engineer and manager of the Hammersmith Electricity Department, died on February 13th, at Penzance, of pneumonia. The funeral service was held at Hammersmith (St. Paul's) Parish Church on Monday, February 18th.

Mr. R. J. Cartwright.—The death occurred on February 18th of Mr. R. J. Cartwright, electrical and lighting engineer, Upton Park, Essex, where he had been in business for 13 years.

Will.—The late Mr. H. T. Newbigin, of Newcastle-on-Tyne, left £12,026 net and £15,370 gross personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

C. Haddon Poupard & Co., Ltd.—Private company. Registered February 18th. Capital, £1,000 in 940 7 per cent. cumulative preference shares of £1 each and 1,200 deferred shares of 1s. each. Objects: To carry on the business of mechanical and electrical engineers, manufacturers of and dealers in accumulators and primary batteries, wireless receivers, gramophones, motors, sound reproducing instruments, wireless loud speakers and components, &c. The first directors are: C. H. Poupard, electrical engineer (permanent), and Mrs. K. M. Poupard, both of 82, Wanstead Lane, Ilford. Registered office: Thermion Works, 50a, Cranbrook Road, Ilford.

Mitcham Works, Ltd.—Private company. Registered February 19th. Capital, £100,000 in £1 shares. Objects: To carry on the business of makers and suppliers of valves, machines, apparatus, and appliances of every kind and component parts thereof used in connection with the production, recording or transmission of sounds or other signals, or for television or other kind of communication, mechanical and electrical engineers, manufacturers of and dealers in mechanical and electrical appliances, &c. The subscribers (each with one share) are: F. S. Forster, 67, Oxford Terrace, Hyde Park, W.2, clerk; R. Kerrison, "Denholme," 132, Erskine Road, Carshalton, clerk. Registered office: Mitcham Works, New Road, Mitcham Junction.

British and Polish Engineering Co., Ltd.—Private company. Registered February 20th. Capital, £5,000 in £1 shares. Objects: To acquire and obtain contracts for the construction of electric lighting plants, gas and sewage works, public and municipal buildings and the like, in Poland or elsewhere in Europe, and to acquire and obtain exclusive concessions for the supply of electric light, gas, traction or power in Poland or elsewhere. The directors are: O. C. Ormsby, M.I.C.E., 194, Staines Road, Sunbury-on-Thames; F. O. Reynolds, M.I.C.E., Braemore Lodge, Sundridge Avenue, Bromley, Kent; E. E. Petersen, St. Krzyzka, 17, Warsaw, Poland; W. H. Godfrey, The Moorings, Vicarage Road, Hampton Wick, Middlesex. Secretary: O. C. Ormsby. Registered office: Lincoln House, 300, High Holborn, W.C.1.

Gordon Hughes Electrical Co., Ltd.—Private company. Registered February 18th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electrical contractors, engineers, manufacturers of and dealers in electrical accessories, and wireless, telegraphy, telephony, and television parts, &c. The first directors are: G. Hughes, electrical contractor, and Mrs. Olive Hughes, both of 72, Tetley Road, Hall Green, Birmingham. Registered office: 163, Moor Street, Birmingham.

Modern Electrical Supplies (Leeds), Ltd.—Private company. Registered February 19th. Capital, £500 in £1 shares. Objects: To adopt an agreement with J. Vashafski and to carry on the business of electricians, electrical engineers and contractors, mechanical engineers, suppliers of electricity, &c. The subscribers (each with one share) are: D. Hyams, merchant, M. Hyams, manager, both of 34, Harehills Avenue, Leeds. Secretary: M. Hyams. Registered office: 98b, North Street, Leeds.

Wardon Manufacturing Co., Ltd.—Private company. Registered February 14th. Capital, £1,000 in £1 shares. Objects: To acquire the business of wireless manufacturers and engineers now carried on by W. J. Ward as "W. J. Ward and Son," at 55, Churchfield Road, Acton, W. The subscribers (each with one share) are: A. E. L. Sawdy, 25, Elmwood Road, Chiswick, W.4, accountant; W. J. Ward, 55, Churchfield Road, Acton, W.3, wireless manufacturer. Secretary: S. J. S. Parker, 162, High Street, Acton, W.3.

Electrical Manufacturers' Finance Co., Ltd.—Private company. Registered February 15th. Capital, £10,000 in £1 shares. Objects:—To carry on the business of financiers, bankers, &c. The subscribers (each with one share) are:—E. H. W. Cooke, "Sunnyhill," The Clumps, Rickmansworth, accountant. C. Collins, "Orchardcombe," Orchard Road, Bromley, accountant. The first directors (to number not less than two or more than five) are to be appointed by the subscribers. Remuneration as fixed by the company. Solicitor: A. R. Monks, Crown House, Aldwych, W.C.2.

Wireless-Electric (Wholesale), Ltd.—Private company. Registered February 16th. Capital, £1,650 in £1 shares. Objects:—To acquire the business of a wireless factor and electrical supplier now carried on by C. E. Coulson at 23, North Street (City), Bristol, as "Wireless Electric Wholesale." The directors are:—C. E. Coulson, 24, North Street, Stokes Croft, Bristol; Mrs. Florence M. Coulson, 24, North Street, Stokes Croft, Bristol. Qualification, £100 shares. Remuneration as fixed by the company. Solicitors: Barnett & Leonard, Bristol.

Radio-Tri-Phone, Ltd.—Private company. Registered February 25th. Capital £100 in 2s. shares. Objects: To carry on the business of manufacturers of and dealers in gramophones, phonographs, records, wireless apparatus, pianos, organs and other musical instruments, electricians, engineers, cabinet makers, woodworkers, carpenters, &c. The directors are: N. H. Fletcher, The Buntings, Ickenham, insurance clerk; W. G. Borrow, 2, Sydenham Park Mansions, S.E.26, incorporated secretary. Registered office: 6, Broad Street Place, E.C.2.

Beam Sign Co., Ltd.—Private company. Registered February 14th. Capital, £2,000 in £1 shares. Objects:—To carry on the business of manufacturers, salesmen, advertising agents, advertisers, distributors and dealers in advertising signs and devices, dealers in electrical, cinematographic or other display pictures or signs, proprietors or managers of theatres and cinematograph shows and exhibitions, manufacturers of and dealers in wireless sets, &c. The directors are:—G. A. Smalley, "St. Benets," Caterham Valley, Surrey; A. E. Leywood, "Bradenhurst," Harestone Hill, Caterham, Surrey (managing director of Adlets, Ltd.). Qualification, 100 shares. Remuneration (except managing director, if any), £100 each per annum. Solicitor: G. J. Armstrong, 24, Bedford Row, W.C.1. Registered office: 20, Kingsway, W.C.2.

Nelson Bros., Ltd.—Private company. Registered February 22nd. Capital, £2,000 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers, manufacturers and workers of and dealers in electricity, &c. The first directors are:—G. R. Nelson, 20, Colwyn Avenue, Blackpool; and A. Nelson and N. Nelson, 1, Sharow Grove, Blackpool (life directors). Registered office: 2, Regent Road, Blackpool.

Official Returns of Electrical Companies.

Lancashire Telephone Systems, Ltd.—Particulars filed of £4,000 debentures authorised February 1st, 1929, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £550.

G. E. Ambatielo & Co., Ltd.—B. L. Clarke-Lens, 76, Newgate Street, E.C.1, was appointed receiver and manager on February 8th, 1929, under powers contained in debenture dated July 9th, 1927.

Phœnix Dynamo Manufacturing Co., Ltd.—Capital, £100 in £1 shares. Return dated October 23rd, 1928. Two shares taken up. £2 paid. Mortgages and charges, nil.

Tubes, Ltd.—Capital, £215,000 in £1 shares. Return dated November 9th, 1928. All shares taken up. £107,584 paid (being £1 per share on 82,859 and 10s. per share on 49,450 shares), £107,416 considered as paid (being £1 per share on 82,691 and 10s. per share on 49,450 shares). Mortgages and charges, nil.

Climax Radio Electric, Ltd.—Capital, £5,250 in 5,000 preference shares of £1 each and 5,000 ordinary shares of 1s. each. Return dated December 5th, 1928. 3,340 preference and 5,000 ordinary shares taken up. £418 10s. paid on 406 preference and 250 ordinary shares, £3,171 10s. considered as paid on 2,934 preference and 4,750 ordinary shares. Mortgages and charges, nil.

Flinders (Wholesale), Ltd.—Capital, £7,000 in 3,000 convertible 8 per cent. preference and 4,000 ordinary shares of £1 each. Return dated October 18th, 1928. 3,000 preference and 3,000 ordinary shares taken up. £6,000 paid. Mortgages and charges, nil.

Radio Service (London), Ltd.—Satisfaction to the extent of £125 on January 15th, 1929, of debenture dated July 25th, 1927, securing £2,750.

Siemens Bros. & Co., Ltd.—Satisfaction to the extent of £33,400 on January 1st, 1929, of trust deed dated January 15th, 1918, securing £1,330,000 debenture stock.

C. F. Casella & Co., Ltd.—Issue on September 30th, 1925, of £100 debentures, part of a series already registered. (Notice filed February 8th, 1929.) Satisfaction in full on February 3rd, 1929, of debentures dated January 21st and September 30th, 1925, securing £1,500.

Rangoon Electric Tramway and Supply Co., Ltd.—Satisfaction to the extent of £10,970 on April 30th, and to the extent of £372 on November 27th, 1928, of debenture stock dated February 1st, 1906, to January 25th, 1924, securing £250,000. (Notice filed February 12th, 1929.)

Strange & Sons Electrical Engineering Co., Ltd.—Capital, £200 in £1 shares. Return dated November 27th, 1928. 69 shares taken up. £69 paid, plus £9 per share premium. Mortgages and charges, nil.

Magna Wire and Cable Co., Ltd.—Capital, £11,000 in 10,000 preference shares of £1 each and 20,000 ordinary shares of 1s. each. Return dated November 30th, 1928. 2,027 preference and 11,500 ordinary shares taken up. £2,027 paid on the preference shares. £575 considered as paid on the ordinary shares. Mortgages and charges, nil.

Siemens-Schuckert (Great Britain), Ltd.—Capital, £10,000 in £1 shares. Return dated December 21st, 1928. 400 shares taken up. £400 paid. Mortgages and charges, nil.

Electroflo Meters Co., Ltd.—Capital, £21,000 in £10 shares. Return dated December 5th, 1928. 2,090 shares taken up. £10,900 paid. £10,000 considered as paid. Mortgages and charges, nil.

S. A. Cutters, Ltd.—Capital, £3,000 in 1,000 preference and 2,000 ordinary shares of £1 each. Return dated July 19th, 1928. 2,000 ordinary shares taken up. £1,000 paid. £1,000 considered as paid. Mortgages and charges, nil.

Ferranti, Ltd.—Capital, £300,000 in 100,000 6 per cent. preference, 100,000 7 per cent. second preference, and 100,000 ordinary shares of £1 each. Return dated November 1st, 1928. 71,166 6 per cent. preference, 75,000 7 per cent. preference, and 60,000 ordinary shares taken up. £206,166 considered as paid. Mortgages and charges, nil.

O. S. Choppin & Co., Ltd.—Capital, £1,000 in £1 shares. Return dated June 6th (filed October 29th), 1928. 702 shares taken up. £2 paid. £700 considered as paid. Mortgages and charges, nil.

Premier Wholesale Electric Co. (Stockport), Ltd.—Capital, £2,000 in £1 shares. Return dated September 11th, 1928. 1,200 shares taken up. 17s. 6d. per share called up on 800 shares. £700 paid. £400 considered as paid on 400 shares. Mortgages and charges, £268 19s. 11d.

City Notes.

The " Underground " Group.

The reports of the four electric railway companies of this group were reviewed in our last issue (p. 343). On February 21st the combined annual meeting of shareholders was held; Lord Ashfield, the chairman, was absent through indisposition, and his address was read by Mr. H. A. Vernet. In this address it was pointed out that for the first time in ten years the results had been truly satisfactory; this made them more hopeful of the future. The number of passengers carried (1,803 millions) was the highest ever reached by the group, and was the reward of their enterprise in the development of new districts by the extension of their services. Other causes of the increase were the acquisition of the businesses of independent 'bus companies and the exceptionally good weather during 1928. The directors had adopted a prudent policy; while satisfying the shareholders' desire for a larger dividend, they had strengthened the companies' position. The average rate of dividend since the inception of the Common Fund in 1915 had been 3 per cent.; last year the rate was 5.69 per cent. Since the war £21,000,000 had been spent on capital account, and almost the whole of the amount represented had taken priority of the capital. Dealing with the nature of London traffic, the address pointed out that although the average number of journeys per head of population in 1928 was 510, that figure was still surpassed by New York with 563. There was no apparent check upon growth, and so they could look forward to further progress. The undertaking could not stand still, but the end of the current programme was in sight, and they had come to the limit of their present resources. They had not yet reached a position in which they could hope to raise fresh capital by the issue of ordinary stocks and shares at par. Until they could reach and maintain such a position their ambition was thwarted and their future was not safe. The prior charge securities represented 69 per cent. of the total capital, leaving only 31 per cent. (£17,000,000) in ordinary stocks and shares. The Common Fund arrangement had proved beneficial to everybody concerned; a wider common fund and a broader common management were the cure for the troubles which beset the outer suburbs. Therefore they and the London County Council had promoted Parliamentary Bills to secure this co-ordination. New underground railways were necessary to connect the newer suburbs with the centres of commerce and trade and to relieve the surface traffic congestion. The most urgent development was the extension northward of the Piccadilly section of the London Electric Railway. That was the task which they would set before themselves as soon as they were able to raise the requisite capital. If they could obtain a settlement of the scheme for co-ordination covered by the Bill they would ask the shareholders to venture on the execution of the work. The address concluded with a review of the co-ordination proposals. The reports were adopted, and the Bill was approved.

Power Securities Corporation, Ltd.

The annual meeting was held on February 20th, when Mr. George Balfour (chairman), who presided, said the Lochaber tunnel and hydro-electric works were nearing completion. About a half of the 15-mile tunnel had been concrete lined. The effect of the general strike and coal dispute had been to cause a year's delay, and as a provision against the contract they had left the whole of the profits on other work carried out during the year by Balfour, Beatty & Co., Ltd., in the accounts of that company as a reserve. In addition to the important Lochaber scheme, they had completed during the year a large amount of work in Argentina, including two complete power-station plants totalling 45,000 h.p., and, in addition, they had dealt with a certain amount of plant and other works for Indian and African undertakings and a large volume of mixed construction work in Great Britain. Rapid progress was being made with the Grampians hydro-electric development, which was commenced during the early part of the year. A duplicate transmission line from East Forfarshire to the power station at Rannock (over 75 miles) was under construction, and supplies from the steam reserve station had been given to hitherto unserved districts. They had in hand at the moment other engineering and construction work aggregating about 2½ million pounds, all of which was on a secure basis of remuneration. They had refused financial business in certain directions; in particular, they had declined some business in the electricity supply industry, which, although it would probably have provided a quick profit, would have been effected at valuations which they could not reconcile with the merits of the property; or alternatively at valuations on a basis of early prospective yield much lower than from gilt-edged securities. During the year they had handled public issues for seven electricity supply and allied undertakings to an amount aggregating some £3,000,000, in addition to advances of a temporary nature to similar properties. They had taken over a concession for electric light and power supply for Jerusalem and Bethlehem, and had formed the Jerusalem Electric and Public Service Corporation, Ltd. They hoped also to acquire the water concession for the city. Some little time ago they were asked to take over the administration of a Spanish light and power property. They acquired a large interest in it and had turned a loss of £24,000 per annum into a profit, and the construction of a hydro-electric plant should bring the undertaking into a very satisfactory financial position. After referring to other business undertaken by the company, the chairman reviewed the accounts, noting that the reserve had been increased to £130,000, and that they had set aside £10,000 to form the nucleus of a dividend-equalisation fund. The report and accounts were adopted.

Atlas Light and Power Co., Ltd.

On February 21st an extraordinary meeting was held in connection with the sale of the company's Argentine electricity supply and traction properties to the American and Foreign Power Co., of New York. Mr. W. Sandford Poole, who recently succeeded Sir George A. Touche as chairman, presided, and after reviewing the history of the company, proceeded to detail the negotiations which led to the matter before the meeting. On receipt of inquiries the directors stated that the company had acquired the Argentine properties with a view to developing them itself, and no such price as the inquirers offered could be entertained. It was made clear that the board would not consider any amount less than £8,500,000, and the buyers then expressed their willingness to pay this sum. In addition, a further amount was stipulated on account of unremitted earnings. The agreement provided, *inter alia*, that the Atlas Company should secure the resignation of the directors of the subsidiary companies concerned; that the company should have the option to take up 100,000 shares of preferred stock of the South American Power Co.; and that, for at least ten years, British manufacturers should be given preference for the bulk of the electrical equipment required, other things being equal. A compensation fund of £37,500 was being provided for those who would be adversely affected by the sale, including the technical adviser and the managing director. No part of the fund would be appropriated to the board as a whole without the sanction of a general meeting of shareholders. The directors recommended the sale of the undertakings. America's great wealth had to find an outlet, and thus the buyers could afford to purchase investments at a price at which the company could not afford to hold them. The dividend of 5 per cent., which was all they could pay at present, would not justify the price to which the ordinary shares had risen. The cost of the holdings which they were selling was about £5,000,000. Arrangements were being made to deal with the debentures, and they should have upwards of £5,500,000 available for investment and general purposes. After some discussion the motion was approved.

Baird Television Development Co., Ltd.

The first ordinary general meeting was held on February 20th. Sir Edward Manville (chairman), who presided, said that owing to questions which had been asked in the House of Commons the directors had been compelled to call the meeting earlier than they desired. He claimed that the company's system had attained a remarkable degree of perfection, and although at present the " televised " images were on a small scale, they hoped soon to be able to obtain the same degree of perfection on a larger scale. The Baird International Television Co. was in negotiation for the establishment of broadcasting of television on the Baird system in most parts of the world. The company owned two-thirds of the results of the International Co. from dealing with the patents outside the United Kingdom. The International Co. was formed with a capital of £700,000 so arranged as to give a working capital of a sum exceeding a quarter of a million pounds. Negotiations were in progress for the formation of companies in the Colonies and many foreign countries. Transmitting and receiving apparatus was now being installed in the chief Berlin wireless stations, and at least seven Continental broadcasting stations (including Radio-Paris) had invited the company to install transmitters. The company did not intend to manufacture receiving apparatus, but it had produced a number of such instruments to satisfy the first demand to a certain extent. Another direction in which the company was working was " Phonovision," the recording of images for subsequent reproduction with the sounds corresponding to them. Then there was also " Noctovision " and fac-simile telegraphy. One side line from which they were drawing royalties was a distortionless amplifier circuit. Arrangements had been made with an important French company for the establishment of broadcasting and television in almost all the principal centres of the Continent. After the chairman had answered a number of questions, the report was adopted.

Electrical Distribution of Yorkshire, Ltd.

The accounts for the year ended December 31st last show a profit of £78,281, as compared with £63,217 in 1927. To this is added £18,723 brought forward, making £97,004. From this a dividend of 9 per cent. is paid (4½ per cent. distributed in August last); £17,800 is placed to the reserve fund (making £77,500); and £21,904 is carried forward. A substantial reduction in the price of electricity was made in April last.

During the last two years some 15,000 new consumers have been connected. The domestic uses of electricity are being encouraged by the provision of apparatus on special terms, and there is an increasing demand. During the year additional agreements for street lighting were made with twelve local authorities. The company has been authorised by Parliament to supply in a number of parishes in the Skipton rural district and in the township of Austhorpe, and the Electricity Commissioners intend to make an Order enabling the company to supply in part of the Worksop rural district. With this addition the company's area will be increased to 1,197 sq. miles with a population of 744,000. In November, 1928, the shareholders authorised an increase of the nominal capital of the company from £1,000,000 to £1,500,000. The large capital expenditure already made and the additional expenditure required to meet new demands necessitates the provision of further capital, and an issue of 600,000 ordinary shares of £1 each will be made to the shareholders shortly after the annual meeting (March 5th) at 25s. per share. This will increase the issued capital to £1,400,000.

Yorkshire Electric Power Co.

Presiding at the annual meeting on February 19th, the chairman (Mr. A. G. Lupton) said that the amount of energy sold during 1928 increased by 8 per cent. Local rates were a growing burden and were approaching the item of fuel in their cost sheets; it was anomalous that the company should not obtain relief from the new Rating Act, and it behoved all engaged in industry to see that their local authorities exercised the strictest economies. The demand for supply in bulk continued to grow, and during the year they had made an agreement with the Gainsborough Urban District Council. The company was seeking powers to supply in parts of the counties of Derby, Lincoln, Nottingham, and the East Riding of Yorkshire; those districts all adjoined the existing supply area, so that the mains could be readily extended to them. They considered that these rural areas could be best served by an already-established company. Referring to the stated tendency of industry to migrate southward, Mr. Lupton said that the facilities for industry in the West Riding were excellent. It was the company's policy to encourage the establishment of new industries by supplying electricity at low prices and rendering service in other directions. The average price of their electricity last year was less than ¾d. per kWh. Under the recently-issued Mid-East England Electricity Scheme three of the company's stations would be "selected," and Ferrybridge and Thornhill would be two of the five "base" stations. The company would assist the Central Electricity Board in developing the supply of electricity in the area in the most rapid and efficient manner.

North Metropolitan Electric Power Supply Co.

The directors' report for the year ended December 31st last records a net profit of £374,621 (against £358,271), to which is added a balance brought forward of £19,042, making £393,663. After meeting debenture charges, &c., transferring £120,705 to reserve, and paying the preference dividends, a total dividend of 10 per cent. for the year is paid on the ordinary shares, leaving £28,202 to be carried forward. The capital expenditure during the year amounted to £501,221. Approximately 133 miles of underground and 44 miles of overhead trunk and distributing mains have been laid or erected, making the total length 1,294 miles, and 53 new sub-stations have been put into service, bringing the total up to 311. The sales of electrical energy increase from 143,700,000 kWh to 164,300,000 kWh, an increase of 14 per cent., and the total number of consumers supplied either directly or indirectly rose from 85,000 to 99,300. A supply of electricity was extended during the year to a number of rural districts, including Ashwell, London Colney, Much Hadham, Puckeridge, Redbourn, Standon, Wheathampstead, and Harlow. Further reductions in the rates of supply were introduced from March, 1928, throughout the area. New showrooms have been opened at Barnet and Tottenham, and the new generating station at Brimsdown has been running on load (but not in full operation) since October last. The North Metropolitan Electric Power Supply (Consolidation) Bill received the Royal Assent on August 3rd, 1928.

Metropolitan Railway Co.

Lord Aberconway (chairman) presided at the annual meeting on February 21st, and in presenting the report and accounts (*vide* our last issue, p. 343) said that in view of the continued trade depression last year's results were satisfactory. The increase in the long-distance traffic (coupled with a decrease in short-distance business) was causing them some embarrassment in the matter of rolling stock. They were replacing the older corridor cars by compartment stock, and they had found it necessary to increase the length of trains during rush hours. Parliament had refused the company powers to operate on the roads, but its investment powers had enabled it to make arrangements with an outside company which would put it in an equally good position to exercise some control over the operations of competing 'bus services. After referring to the rating relief measure of the Government and the company's new Baker Street building, Lord Aberconway said that they had replaced a 5,000-kW set at the Neasden power station by an up-to-date 20,000-kW set, which had been in operation since June last, effecting considerable economies. The original boiler plant was to be replaced by six new high-pressure boilers fitted for pulverised fuel. The report and accounts were adopted, and the company's Bill seeking powers to widen the line between Wembley Park and Harrow, &c., was approved.

Northampton Electric Light and Power Co., Ltd.

The directors' report for the year ended December 31st last shows a total income of £173,529, and a net revenue of £69,183, after providing £34,342 for depreciation. After meeting debenture interest, &c., adding the balance brought forward (£9,910) and income from investments (£3,209), a sum of £8,000 is carried to reserve, and £2,000 to the employés' benevolent fund. A final dividend of 5 per cent. on the old ordinary shares is recommended, making 9 per cent. for the year (as for 1927), and £9,690 is carried forward. Two Special Orders were obtained during the year authorising the company to supply electricity in Brackley, Buckingham, Winslow, and rural areas in Northamptonshire and Buckinghamshire. A number of villages were connected to the system. The maximum load rose to 14,360 kW, and the amount of electricity sold increased from 22,578,800 to 26,574,837 kWh.

Rushden and District Electric Supply Co., Ltd.

The total income for the past year was £22,907, and the net revenue, after providing for depreciation, £6,864. From this debenture charges are met, £401 is written off debenture expenses, and £500 is transferred to the reserve fund. A final dividend of 4½ per cent. is proposed, making 8 per cent. for the year, as in 1927, leaving £1,250 to be carried forward. The sales of electrical energy rose from 1,602,759 to 2,256,704 kWh. A proposal for increasing the capital will be laid before an extraordinary general meeting which is being convened.

Midland Counties Electric Supply Co., Ltd.

The trading profits during 1928 of the companies owned and operated by this company amounted to £306,510 (against £250,031 in 1927). The undertakings appropriated £80,274 for depreciation and reserves, and the balance at credit of profit and loss (including £4,106 brought forward) is £217,810. After meeting debenture interest, &c., and placing £15,000 to investment reserve, the directors again propose to pay a dividend at the rate of 6½ per cent. per annum upon the old ordinary shares, and at the same rate on instalments upon new ordinary shares, leaving £5,675 to be carried forward. The report states that the demand continued to grow satisfactorily and further generating plant was put into commission. Further necessary extensions are now in hand. During the year an issue was made of 250,000 preference and 500,000 ordinary shares, and the premium on these has been credited to the investment reserve account. Meeting: March 4th.

Dublin United Electric Tramways Co., Ltd.

At the annual meeting on February 19th, the chairman, Mr. William Hewat, in the course of his address, said that in a recent letter the company had been informed that it was required to take its electricity from the Electricity Board as soon as the Shannon works were in a position to supply electricity, which was estimated to be before the end of the current year. The questions arose: What were the terms on which the supply in bulk was to be given?; and How was the company's valuable power station at Ringsend to be dealt with? Presumably the station would no longer be required. They were awaiting a communication from the Board on that important question. At the same time he had no reason to assume that the claims of the company would not be fully recognised, and fairly dealt with, or that the Electricity Board would adopt a policy of confiscation in relation to it.

Stock Exchange Notices.

Dealings in the following have been allowed by the Committee under Rule 159:—

Simms Motor Units, Ltd.—100,000 6 per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 1 to 100,000.

West London and Provincial Electric and General Trust, Ltd.—18,000 new shares of £5 each, fully paid, Nos. 1 to 18,000.

Newcastle-upon-Tyne Electric Supply Company.—1,400 new five per cent. preference shares of £1 each, fully paid, Nos. 1,537,553 to 1,538,952. (Ranking for dividend from January 1st, 1929.)

Underground Electric Railways Company of London.—3,109 new shares of £1 each, fully paid, Nos. 7,061,165 to 7,064,273. (Ranking for dividend from January 1st, 1929.)

Utilities Power and Light Corporation.

Reuter (New York) reports that the United Utilities Power and Light Corporation, which has acquired all the ordinary shares of the Greater London and Counties Trust, Ltd., offered on February 20th, $36,000,000 of 30-year 5 per cent. debentures with stock purchase warrants. Part of the proceeds of the debentures, which are priced at 98, and interest, will be used to withdraw 5½ per cent. debentures. There was no mention of British financing in the announcement.

London and Suburban Traction Co., Ltd.

The receipts from investments, &c., for 1928 rose by £4,922 to £55,381. The net income was £10,141, to which was added £25,996 brought in, making £36,137, which is carried forward. It is stated in the report that the combined receipts of the Metropolitan Electric Tramways, the London United Tramways, the South Metropolitan Electric Tramways and Lighting Co., and the M.E.T. omnibus undertaking increased by £185,179 to £2,404,938 and the surplus by £70,632 to £95,560. The number of passengers carried rose by 22,149,122 to 323,050,448.

London United Tramways, Ltd.

The traffic receipts for the past year rose by £41,234 to £453,447, while the net income was £16,698 higher at £68,483. After deducting fixed charges there remains a balance of £14,589 (against a loss of £2,445), which is applied to the reduction of the accumulated deficit. The adverse balance carried forward is £53,431. The report states that the number of motor 'buses working over the tramways has become generally stabilised, and improvements in equipment and services have led to a gain in traffic.

Metropolitan Electric Tramways, Ltd.

The accounts for 1928 show traffic receipts totalling £679,369, an increase of £41,518 over the 1927 figure. The net income was £41,677 higher at £164,788. The net result, after providing for fixed charges, was a profit of £17,277; in the preceding year there was a deficit of £25,470. This is applied in reduction of the accumulated deficit, making the amount to be carried forward £80,827. A number of improvements to rolling stock have been carried out, and further developments in this direction are under consideration. Debenture stock to the total amount of £28,287 was redeemed during the year.

Metropolitan Electric Supply Co., Ltd.

The gross revenue for the past year rose by £18,818 to £901,753, and the net revenue by £18,612 to £337,617. After adding interest and £83,508 brought forward, £480,755 is available. Debenture interest, &c., and preference dividends are paid, and the final ordinary dividend is at the rate of 12 per cent. per annum, making 9 per cent. for the year (as for 1927); £87,149 is carried forward. During the year the new connections represented 20,291 kW, making the total 147,730 kW.

North Wales Power Co., Ltd.

At an extraordinary general meeting on February 22nd the proposals for the reduction of the company's capital, &c. (outlined in our last issue, p. 344) were approved. In moving the resolution the chairman (Mr. S. G. Bibby) pointed out that the Maentwrog works had taken nearly two years longer to construct and had cost £300,000 more than was originally estimated. No engineers in the world could have foreseen what the ground was going to be like.

Shawinigan Water and Power Co.

The directors of the Shawinigan Water & Power Co. announced on February 19th a new stock issue on the basis of one new share at $50 for each six held by shareholders on the register on March 22nd. The gross income of the company in 1928 totalled $11,562,000, being an increase of 2¼ millions on 1927. Fixed assets have increased from $68,000,000 to $138,000,000, and the net income is equivalent to $2.83 a share, as compared with $2.63 in 1927, despite the double depreciation provision made in the previous year.—*Reuter* (Montreal).

Ever-Ready Co. (Great Britain), Ltd.

The directors have addressed a letter to the shareholders offering them 395,200 ordinary shares of 5s. each at the price of 20s. 6d. per share. The shareholders are entitled to subscribe for one share for every five shares already held by them. The ordinary dividend for each of the last two years has been 35 per cent. The new capital is required in connection with the acquisition of interests in Lissen, Ltd., and the Ever Ready Trust & Finance Co., Ltd., and the extension of the company's factories and equipment, representing a total expenditure of approximately £380,000.

Smithfield Markets Electric Supply Co., Ltd.

The net profit for 1928, after providing for debenture interest and other charges, and placing £3,000 to debenture stock redemption fund, is £10,778, to which is added £2,530 brought forward, making £13,308. The directors recommend a further dividend of 5 per cent. (1s. per share), for the half-year, making 8 per cent. for the year, and the transfer of £6,000 to reserve, leaving £2,508 to be carried forward.

Torquay Tramways Co., Ltd.

The profit for 1928 was £34,521, and after meeting debenture charges there is a balance of £27,921, plus £1,786 brought forward. £9,712 is put to reserve and renewals, £4,400 to income tax, and after paying 9 per cent., free of tax, for the year, £1,786 is carried forward. The gross revenue rose from £73,015 to £74,853; passengers carried rose from 7,533,841 to 7,775,730; and the number of car-miles run from 742,318 to 758,663.

South Metropolitan Electric Tramways and Lighting Co., Ltd.

The net income for the past year was £65,783, and after deducting interest and other fixed charges and reserving £30,000 for renewals, &c., there remains £26,491, to which is added £9,148 brought forward, making £35,639. A dividend of 5 per cent. is to be paid, leaving £11,139 to be carried forward. During the year 50,000 £1 ordinary shares were issued at par to meet capital expenditure on the electricity supply undertaking and to pay off a bank overdraft.

Crompton Parkinson, Ltd.

The directors announce that in order to correspond with the payment of the dividends on the 8 per cent. first preference shares, they propose in future to declare dividends on the 6 per cent. second preference shares half-yearly, payable on March 31st for the half-year ending the preceding December 31st, and on September 30th for the half-year ending the preceding June 30th, so far as profits may allow. The next half-year's dividend should, therefore, be payable on September 30th next.

Lancashire United Transport and Power Co., Ltd.

The traffic receipts for 1928 increased by £29,645 to £330,576 and receipts from electricity sold, &c., amounted to £27,538, making £358,114. The gross profit was £82,412. After meeting expenses, debenture interest, &c., a balance of £12,554 is carried to depreciation account. It is stated that the business continued to be adversely affected by the state of the coal industry in the area served by the company.

Yorkshire (West Riding) Electric Tramways Co., Ltd.

The net income for the past year (including receipts from the West Riding Automobile Co.) was £28,133 (against £35,600 for 1927). From this the 6 per cent. preference dividend is paid, roadway reinstatement takes £4,876, and depreciation absorbs £11,144, leaving £1,010 to be carried forward. The traffic receipts were again badly affected by the state of trade in the area.

Mather & Platt, Ltd.

The report for the year ended December 31st last shows a net profit of £200,610 (after providing for income tax), against £192,036 in 1927. A balance of £131,945 brought forward is added, making £332,555. The final ordinary dividend is 5 per cent., and a bonus of 5 per cent. is also paid, again making a total distribution of 15 per cent. for the year; £108,006 is carried forward.

Launceston and District Electric Supply Co., Ltd.

The report for the year ended December 31st last shows a net profit, after providing for debenture interest, preference dividends, &c., of £1,326, to which is added a balance brought forward of £1,726, making £3,053. It is recommended that £600 be put to reserve, £800 to depreciation, and that a dividend of 8 per cent. for the year (free of tax) be paid on the ordinary shares, leaving £1,141 carried forward.

National Gas Engine Co., Ltd.

The directors' report for the year ended December 31st last shows a net revenue, after providing for depreciation, &c., of £72,440. After meeting the dividend on the preference shares and transferring £20,000 to general reserve, it is proposed to pay a dividend of 7 per cent. for the year on the ordinary shares (less income tax), leaving £23,050 to be carried forward.

Chiswick Electricity Supply Corporation, Ltd.

After providing for depreciation the net profit for 1928 was £33,442 (against £28,798 for 1927). It is again proposed to pay a dividend of 16 per cent., £9,000 is set aside for consumers' refund (against £5,250), and £2,654 is carried forward. The number of consumers rose from 5,803 to 6,283.

Official Notice re Companies.

The names of the undermentioned companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—

Ace Battery Co., Ltd.
Aldon Portable Wireless, Ltd.
Bradwell Electric Wire and Engineering Co., Ltd.
Gray Electrical Co., Ltd.
Portarlington Electric Light and Power Co., Ltd.
Sparkes Electrical Co., Ltd.
Wireless Warehouses, Ltd.

Companies Struck off the Register.

The names of the undermentioned companies have been struck off the Register and they are thereby dissolved:—

Brotherton, Ediswan Tubes & Conduits, Ltd.
Electro-Hydro, Ltd.
Radieco, Ltd.
Wireless Equipment, Ltd.

Sir W. G. Armstrong, Whitworth & Co., Ltd.

Although there was some criticism of the directors, the proposals for the reconstruction of the company, briefly outlined in our issue of February 15th, were carried by large majorities at meetings of the holders of the company's debentures and shares on February 19th.

Central Electric Supply Co., Ltd.

The balance to the credit of the revenue account for 1928 was £26,894; to this is added £48 brought forward, making £26,942. The "standard" dividend for the year (£7 18s. 5.538d. per cent.) is paid and £1,192 is carried forward.

Barcelona Traction, Light and Power Co.

The company has declared a final dividend of 50 cents per share on the ordinary stock and an additional 1 per cent. on the 7 per cent. non-cumulative participating preference stock.

Clyde Valley Electrical Power Co.

The declaration of a final dividend of 5 per cent. on the ordinary shares maintains the dividend for the year at 8 per cent.

Liverpool Overhead Railway Co.

The directors recommend the payment of a dividend for the year ended December 31st last at the rate of 5 per cent. per annum on the preference shares.

Kensington and Knightsbridge Electric Lighting Co., Ltd.

The directors recommend a balance dividend on the ordinary shares of 10.1811d. per share, making up the "standard" dividend for the past year.

Isle of Thanet Electric Supply Co., Ltd.

A dividend of 4 per cent. is recommended on the ordinary shares, as for 1927, and it is proposed to place £30,000 to general reserve and depreciation account.

National Gas Engine Co., Ltd.

The net profit for the past year rose from £51,350 to £72,440. The ordinary dividend is increased from 5 to 7 per cent., and £20,000 (against *nil*) is placed to reserve.

Pennsylvania Water and Power Co.

A dividend of $\$\frac{1}{4}$ per common share has been declared in respect of the quarter ending March 31st.

Cowans, Sheldon & Co., Ltd.

An interim dividend of 5 per cent., actual, less tax, has been declared.

Swiss Company.

The *Alioth Electricity Co.*, of Basle, reports an increase in the net profits from 422,000 fr. in 1927 to 573,000 fr. last year, and the dividend is advanced from 6 to 7 per cent. The share capital is to be increased from 6,000,000 to 12,000,000 fr.

German Company.

The report for 1928 of the *Electro Works Company*, which is entirely owned by the German Reich and whose works are situated on the site of the lignite deposits near Bitterfeld, states that the production increased from 1,677 million kWh in 1927 to over 2,000 millions last year. Owing to the conclusion of new contracts, the extensions at Zschornewitz, Trattendorf, and Lauta were expedited, and the total capacity available will soon be 700,000 kW. The net profit amounts to 5,220,000 marks, as compared with 5,150,000 marks in 1927, and the dividend remains at 8 per cent.

Stocks and Shares.

Monday Evening.

The fear, to which reference was made here last week, in regard to the possibility of another rise in the Bank of England rate, has proved so far to be groundless, and Stock Exchange markets are now hoping that the period of stringency can be surmounted without the necessity for giving the financial screw another twist. In any case, the present 5½ per cent. Bank Rate is sufficiently high to make for restraint on the part of a good many investors, whose inaction finds reflection in the more passive attitude adopted by the speculative brigade that has been hanging upon America and American influences. Business in the Stock Exchange markets is quiet, though here and there spurts of activity enliven markets where sometimes these spurts are not expected. One such may be illustrated by mention of County of London Electric ordinary shares, which, quiet and steady-moving as a rule, have come up very rapidly indeed during the past few weeks. Investment and speculation are intent upon the endeavour to foresee what effect the result of the forthcoming General Election will exercise upon Stock Exchange prices. The readiness to support Election anticipations finds vent in dealings in what are called "Majorities"—Unionist, Liberal and Labour.

County Electric.

County of London Electric ordinary make, for the time being, the most interesting shares of the market in which they are dealt with. An accession of lively buying ran up the price from 52s. to 57s. 3d. without a break. Various rumours flew into circulation to account for this boomlet. The most popular report was that which hinted at the County of London Company having under contemplation a scheme for the segregation of various assets, and of forming a new trust company to take them over. (Here, it may be remarked, is one of the new and popular developments of to-day's finance.) The report obtained a certain degree of attention, and of admission that it contained the likelihood of favourable consideration from the County of London directors. Caution was inclined to regard the idea as being premature, and, on this latter view, the price of the shares reacted to 53s., leaving a net gain of a shilling on the week.

London Electricity Supply.

The late spell of severe weather, with its queues of oil buyers outside suburban shops, and its processions of frozen-out householders carrying pails of water, is said to have given a brisk impetus to the demand for radiators and other electrical apparatus. Consumption of energy no doubt increased amongst private users. The London electricity supply companies are declaring the same dividends as those of a year ago, but the County Company's results are not out at the time that this is being written. The Metropolitan Company's 12 per cent. makes 9 per cent. for last year, the same as for 1927, and the price of the shares drooped to 45s., on a shade of disappointment with the figures. Electric Supply Corporations hardened to 57s., and London Electrics at 27s. 6d. gained sixpence.

Provincial Electrics.

Midland Counties Electric ordinary are firm at 30s. 6d. on the issue of an annual report that shows solid progress. Gross profits rose £56,500, to £306,500. The dividend on the ordinary shares is repeated, at 6½ per cent. The capital was increased last year by the issue of half a million ordinary shares and 250,000 preference. A rise to 2¼ in Electrical Distribution of Yorkshire ordinary shares followed upon the report, and the news that the company is about to offer 600,000 new ordinary shares at 26s. to its proprietors. This is the same price as that of the 1928 issue, when 300,000 shares were offered. Isle of Thanet Electric ordinary advanced to 41s. 3d. on gossip to the effect that the company is going to be taken over by one of the bigger brethren. Shropshire, Worcestershire and Staffordshire ordinary rose to 21/16. The inclusion of Edmundson's in the septet of electricity supply concerns acquired by the Utilities Power and Light Corporation, led to demand for Urbans. The price rose 3/16 to 44s. 6d.

New Ever-Ready Issue.

A new issue of shares, at 20s. 6d., is offered to its proprietors by the Ever Ready Company (Great Britain), Ltd. One new share is available in respect of every five old shares held. The Ever Ready Trust and Finance Company guarantees the issue for a fee of £11,000. Seeing that the old Ever Ready shares stand at 24s. 6d., it may well be asked why the company should pay anything at all for a guarantee that looks so superfluous. The £11,000 might have gone to Ever Ready shareholders by offering them the new shares, of which there are 395,000, at a pound instead of sixpence higher. The new Ever Ready shares changed hands actively on the basis of 2s. 6d. premium above the issue price.

A Hundred Points Rise.

From the spectacular point of view, the most striking movement in the Stock Exchange lists, during the past week, was a rise of exactly 100 points in British Electric Traction deferred ordinary stock. So slight is the public interest taken in the stock that the advance attracted scarcely any notice. Stock has changed hands at 910 and 935. Market opinion was voiced here, a few weeks ago, as to the likelihood of the price attaining a four-figure level in the near future; the quotation has been putting on 50 points or more, almost every week, with a monotonous regularity. To-day's financial disposition sets strongly in the direction of the bringing under one control, or group, a number of other undertakings. The British Electric Traction deferred ordinary stock consists of a bagatelle, £147,888. The company has substantial interests in electrical, tramway, telegraph, railway, commercial and industrial undertakings, foreign bonds, &c.

Tubes and Trams.

The Home Railway market is better, and Underground income bonds are a point higher than they were this time last

year. The Metropolitan Railway meeting was interesting, by reason of a speech from the chairman which suggested that the company's limit of expansion is still very far from being reached. The Underground Electric Railways of London held its meeting on the same day, and Lord Ashfield was quietly confident of the approach of the time when the company, or the group, will be so unified that a passenger can have complete freedom of travel in London, through exchange of fares and tickets. There has been a slightly better tendency amongst Home Railway stocks as a whole. Tramway descriptions are dullish. London & Suburban Traction preference have gone back another 6d. to 12s., and the ordinary to 4s. 3d. London United Tramways preference are quoted at 8s.; the ordinary at a florin. Metropolitan Electric Tramways ordinary were last done at half-a-crown, the preference at 6s. 3d. Tilling and British Automobile Traction ordinary are moving between 2 and 2¼. Business took place last week in Aldershot and District Traction ordinary at 31s. 6d. The old shares and the new partly-paid stand relatively at nearly the same levels.

The Atlas Argentine Sale.

Atlas Light and Power ordinary shares underwent no change, from the previous price of 28s., on last week's meeting, at which a large majority of holders approved the resolutions for sale of the Atlas holdings in Argentine subsidiary companies. The chairman stated that the properties to be sold for 8½ million pounds sterling "probably stand at about five million pounds in the company's accounts." The money remaining over, after the deal is completed, will be available for the purchase of general investments, and possibly the acquisition of other electrical holdings.

Dollar Stocks.

Brazilian Tractions are a point up, at 71, and San Paulo Tramway 5 per cent. first mortgage debentures are similarly higher at 103½. Shawinigan Water dropped 2, to 89½. Power Corporation of Canada, of no par value, are lower at 121. Pennsylvania Water and Power common have gone back to 93. Montreal Light, Heat and Power shares remain tolerably firm at 116. Movements in the Mexican utility group are somewhat uneven.

Indian and Other Shares.

The disturbances in India have had no marked effect upon prices of shares in the Indian companies. Calcutta Electric Supply ordinary are 58s. 9d., and Calcutta Tramways ordinary 20s. Madras Electric Supply ordinary keep at about 35s., and Delhi Electric Supply ordinary at 52s. 3d. Tata Power 7½ per cent. "B" debenture is unchanged at 104: the company's 4½ per cent. "A" debenture comes into the Trade Facilities Act stocks guaranteed by the British Government, and the price is 97. Another in the T.F.A. group is the 5 per cent. debenture stock of the Perak River Hydro-Electric Power Company, and the price is 100. The company's 7 per cent. participating debenture stock stands at 118, at which price a transaction was recorded to-day, Monday, and the shares have attracted moderate attention around 19s. 6d. North Wales Power 4½ per cent. debenture stock, another Trade Facilities issue, came in at 96½: the ordinary shares are quoted at about 15s. 3d. Mersey Power 6 per cent. preference change hands occasionally at 23s. Hendon Electric ordinary stand at a shade above £3. The new London Power 5 per cent. debenture scrip, offered at 99½, has strengthened to 5s. premium.

Wireless and Cables.

Marconis have improved to 4 1/16, expectation being on tenterhooks in regard to the terms which shareholders will be offered in the new Communications scheme. It is declared that an official announcement is on the eve of being published. The Eastern cable group found, however, no comfort in this rumour, and the prices of its stock and shares are lower, though to no important extent. Marconi Marines gave up the rise of 2s. 6d. which their price secured last week. Canadian Marconis, on a few American purchases, rallied to 31s. Bogota Telephones are slightly better at 28s. 6d.; Venezuela Telephones, ordinary and preference, lost a few pence at 28s. Baird International Television "A" shares went back to 11s. 3d. Baird Television Development 10 per cent. participating preferred ordinary last changed hands at 35s. 9d., and the deferred ordinary at 13s. 6d. Telephone Manufacturing shares at 5s. 3d. show a small gain.

Manufacturing and Equipment.

Callender's Cable ordinary are a good market, with a rise of 1/16, to 4⅜. Otherwise, the manufacturing and equipment companies' shares exhibit a dullish disposition. British Insulated have gone back to 4⅜, and Johnson & Phillips to 38s. 9d. India Rubber shares weakened to 11s. 3d. Amongst engineering issues, Babcock & Wilcox reacted to 70s. Vickers at 11s. 7½d. are a trifle better than they have been. The rubber share market is enjoying a new lease of life. Upon a rise in the price of the product to 1s. 1½d. per lb., a general improvement occurred in share values. As usual at such times, the main difficulty was to find shares with which to supply the would-be buyers. It may be said, therefore, that the substantial advance in prices was out of due proportion to the amount of actual business which accompanied it.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Dividend. 1926.	1927.	Price Feb. 25, 1929.	Rise or fall.	Yield p.c.
	£					
Bournemouth and Poole	1	14†	15	72/-	—	...
Brompton Ordinary	1	8⅝	8½	27/-	—	5 9 6
Charing Cross Ordinary	1	8½	8½	26/6	+6d.	5 5 6
do. do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅝	8⅝	27/-	—	5 3 6
City of London	1	10	10	89/-	—	4 7 6
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	2	—	4 2 0
County of London	1	7½	7½	53/-	+1/-	2 16 9
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundsons' 7% Pref.	1	7	7	25/-	—	5 12 0
Elec. Supply Corporation	1	11	11	57/-	+9d.	3 17 0
Kensington Ordinary	1	8	8	27/-	—	5 8 6
Lancs. Light and Power	1	7½	7½	30/-	—	5 0 0
London Electric	1	8½	8½	27/6	+6d.	5 1 10
Metropolitan	1	8	9	2½	—⅛	4 0 0
do 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6	6½	30/6	—	4 5 9
Mid. Elec. Power	1	—	15	2⅛	—	...
Newcastle-on-Tyne Ordinary	1	5	6	26/3	—	4 11 5
do. 7% Pref.	1	7	7	26/6	—	5 5 6
Notting Hill 6% Pref.	10	6	6	10⅝	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	1	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	34/-	—	4 14 9
South London	1	8½	8½	27/6	—	5 2 6
Urban Ordinary	1	7	7	44/6	+⅛	...
Westminster Ordinary	1	8½	8½	27/-	—	5 3 6
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	24/9	—	6 1 3
Yorkshire Elec.	1	8	8	36/-xd	—	4 9 9

†4% of which was tax free.

Home Rails.

Central London Ord. Assented	Stock	4	4	72xd	−1	5 11 1
Metropolitan	,,	9	9	65	—	5 7 8
do. District	,,	8½	4	80½	—	5 4 8
Underground Electric	£1	1½	5	25/6	—	5 9 10
do. do. Income	Bonds	6	6	122	+1	4 18 4

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	108	—	5 16 6
do. Def.	,,	1½	1½	24½	—	6 2 5
Automatic Telephone	1	10	10	9⅛	+⅛	4 14 1
Eastern Extension	...	10	10	96⅝	−½	*5 15 9
Eastern Tel. Ord.	Stock	10	10	265½	−2	*5 15 6
Globe Tel. and T. Ord.	10	10	10	96⅝	−½	*5 15 9
do. do. Pref.	10	6	6	11½	—	5 9 6
Great Northern Tel.	10	20	20	33	—	...
Indo-European	25	10	10	55½	+1	*4 10 6
Marconi	10/-	5	*10	4⅛	+⅛	...
Marconi-Marine	1	8⅝	19½	8⅜	−⅛	5 9 9
Oriental Telephone Ord.	1	12	12	9⅛	—	...
Western Telegraph	10	10	10	96⅝	−⅛	5 15 9

*Interim.

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	9⅞	—	7 6 6
do. do. 2nd. Pref.	5			9⅜	—	8 5 6
do. do. 5% Deb.	Stock	5	5	77	—	6 9 10
British Electric Traction Def. Ord.	,,	—	—	925	+150	...
do. do. Pref. Ord.	,,	8	8	128	—	6 5 0
Brazil Traction	100	6	7	71	+1	2 16 4
Brit. Colombia Elec. Rly. Pcc.	Stock	5	5	96½	—	5 3 7
London & Sub. Trac. 5% Pref.	1	Nil	Nil	12/-	−6d.	...
London United Tram Deb.	Stock	4	4	61	—	6 11 4
Mexico Trams. 5% Bonds	—	5	5	83½	−½	5 15 9
Mexican Light Common	100	Nil	Nil	92	+2	...
do. 7% Pref.	100	Nil	7	77½	−1	9 0 8
do. 1st Bonds	—	5	5	79	—	6 6 7
Yorkshire (West Riding)	1	Nil	Nil	8/-	—	...

Manufacturing Companies.

Babcock & Wilcox	1	13	15	3½	−⅛	*4 11 3
British Aluminium Ord.	1	10	10	47/6	—	*4 4 2
British Elec. Transformer Pref.	1	7	7	15/-	—	9 6 8
British Insulated Ord.	1	15	15	4⅜	−⅛	3 8 9
Brush Ord.	1	10	10	23/9	—	6 13 5
Callenders	1	15	15	4⅜	+⅛	3 8 6
do 6½% Pref.	1	6½	6½	1⅛	—	5 4 0
Crompton Parkinson Ord.	5/-	—	—	1	—	...
do. 8% Pref.	1	—	8	25/9	—	6 4 8
Edison-Swan 1st. Pref.	1	7½	7½	25/9	—	5 16 6
do. 6% Deb.	Stock	6	6	86½	—	5 15 7
Electric Construction	1	7½	7½	23/9	—	5 16 6
Enfield Cable Ord.	1	20	20	6⅜	—	3 14 6
English Electric	1	Nil	Nil	8/9	—	...
do. do. Pref	1	8	Nil	9/6	—	...
Gen. Elec. Pref.	1	6⅜	6⅜	21/6	—	5 6 1
do. Ord.	1	7½	10	8⅞	+⅛	5 6 0
Henley	1	25	25	6⅛	−⅛	4 1 6
do. 4½% Pref.	5	4½	4½	4½xd	+2/-	5 6 6
India-Rubber	1	Nil	Nil	11/9	−⅛	...
Johnson & Phillips	1	12½	10	1⅛	−⅛	5 3 1
Siemens Ord.	1	7½	7½	80/-	—	5 0 0
Telegraph Construction	12	10	10	25½	—	*4 15 9

*Dividends paid free of Income Tax.

The British Industries Fair.—III.

Functions and Exhibits in London and Birmingham.

THE Fair closes to-day (Friday) after what appears to have been a very successful run. Practically all of the leading organisations of the electrical profession, industry and trade have had an opportunity of inspecting the exhibits, and we hope that they have been duly impressed. These visits of potential customers should prove of great advantage to the exhibitors for, after all, the home market is as important as those abroad, whose representatives are especially invited to the Fair. Last Friday was an "electrical" day at the Birmingham Section. Delegates of several associations turned up in good force, and there was a conference arranged by the British Electrical Development Association, followed by a luncheon. The subject of the speakers at both functions was "Salesmanship." Martin touched upon the salesmanship question which was being stressed so much. He asked for a clearer view of the matter. Some said that we were producing too many types and patterns, while others wanted us to meet every customer's individual requirements. Manufacturers could not follow both directions. Mr. Martin also considered that a little more might be said of the achievements of British industry, instead of stressing its shortcomings.

British Thomson-Houston Co., Ltd.

Berry's Electric (1928), Ltd.

To-day further electrical organisations are paying an official visit to Birmingham. They are the Institution of Electrical Engineers, the Association of Supervising Electrical Engineers, the Electrical Contractors' Association, the E.C.A. of Scotland, the Electrical Wholesalers' Federation, the Electrical Merchants' and Manufacturers' Association, the Association of Mining Electrical Engineers, and the Illuminating Engineering Society. A luncheon is to be held, and we hope to report the speeches in our next issue. In the afternoon members of the Electrical Association for Women are making a tour of the Section.

General Electric Co., Ltd.

Birmingham Electric Supply Department.

Some More of the Stands at Castle Bromwich.

Although the matter has received very considerable attention lately, several new aspects were presented.

On Saturday last members of the Electrical Power Engineers' Association visited Castle Bromwich and were entertained to luncheon. In the course of proposing the toast of "The Electrical Industry," Mr. T. R.

Electrical Organisations at Birmingham.

Conference and Luncheon.

Friday last was an important electrical day at the Birmingham Section of the Fair, when the following organisations paid an official list:—The Incorporated Municipal Electrical Association, the British Electrical Development Association, the Incorporated Association of Electric Power Companies; the Provincial Electric Supply Association; the Municipal Tramway and Transport Association; and the Tramways and Light Railways Association, as well as a number of non-electrical bodies.

Under the auspices of the British Electrical Development Association a conference was held, with Sir John Gatti, president of the Association, in the chair. About 200 ladies and gentlemen were present.

Address by Lt.-Col. Vignoles.

Lt.-Col. W. A. Vignoles, D.S.O., director and secretary of E.D.A., in an address pointed out that the use of electricity had not yet developed very far in this country as compared with the United States. Taking the domestic field alone, less than 25 per cent. of the houses at present in the areas of supply of existing undertakings appeared to be connected. The number of houses in the supply areas of Great Britain was seven millions, and the estimated number of consumers was 1,600,000; the estimated annual increase in domestic consumers was 250,000. There was great scope for additional sales; the field open for the sale of further quantities of electrical energy and for consuming apparatus was enormous. The development of power supply would continue and would rise very rapidly when there was a revival in trade. The field open for the use of electricity for domestic purposes and industrial purposes was almost staggering. The progress in the future would depend on the rate at which the industry could teach the public and persuade the people to use electricity. The electrical industry had strong competitors, and as the Prince of Wales had pointed out, what was essential to-day was expert salesmanship. It did not follow that a man who required a fire wanted an electric fire; and what was necessary was that they should apply themselves to efforts to get prospective consumers in the frame of mind favourably to consider the advantages of electricity. Much could be done by co-operative methods. As to the prospects of new business, Col. Vignoles mentioned, in addition to domestic requirements, the great possibilities that existed with regard to industrial electrical heating. The amount of energy used in works for heating processes was very considerable. A general survey by the N.E.L.A. (United States) of the electrical industrial heating position indicated that the industrial heating load in 1935 would equal the motor load. The available economic industrial heating load was three times the motor load. In 1925 about 5,000 million kWh was sold in the United States for industrial heating. So far as Birmingham was concerned much electricity was being used in works. In four works in that city he found that the power required annually amounted to 7 million kWh, and already they were using electricity for heating purposes to the extent of nearly 3½ million kWh. At the Fair on the previous day he had heard a speaker at a gas industry luncheon state that that industry was too modest and did not adequately push its claims. The British Commercial Gas Association was, however, spending about £100,000 per annum in trying to overcome that modesty. They should bear in mind that the electrical industry had to contend with an enormous gas propaganda. Those interested in electricity, had a much better article to sell than any of their competitors. One point in favour of electricity was that it was free from the disadvantages of combustion. It was no longer true to say that electricity was expensive; in most parts of the country it was cheap. It was not necessary to bring the price down to too low figures if first-rate service was given to the consumer. But the importance of advertising could not be exaggerated, and he asked all sections of the industry to join with the Association to provide the necessary national propaganda. An effort was being made by means of area committees to secure this co-operation.

Sir John Gatti, in thanking Lt.-Col. Vignoles, said it was important that all sections should realise their independence. A break in co-operative effort meant the retardation of the upward movement. He strongly appealed to all engaged in the industry to take a big view for the common interest. A good start had been made; there was now steady progress; and the point had been reached when a little extra effort would give just the right impetus.

Discussion.

Mr. R. A. Chattock, city electrical engineer, Birmingham, in opening the discussion, emphasised the need for pushing the business. He felt that during the past five or six years they had done it at an accelerating rate. Salesmanship was essential; upon it depended the success of an undertaking. In Birmingham salesmanship had been most successful, and to-day 10,000 new consumers were being added yearly. In this connection tribute was due to the work of the contractors who had co-operated admirably. There was a danger lest business should not expand when saturation point from the lighting point of view had been reached; but there was an enormous field for extensions among the existing consumers. He viewed the outlook with regard to industrial uses with optimism, particularly if prices were reduced. At present only the big industrial undertakings could make extensions on big scale lines. Salesmanship should be developed on a broader basis, and great strides could be made through the area committees. It was of the utmost importance that a serious attempt should be made further to conserve their efforts.

Councillor Thickett (chairman, Walsall Electricity Committee) complained that local advertising was not adequate. Salesmanship and propaganda must be carried out on more liberal lines; the gas industry should not be allowed to persist in its monopoly in these things.

Mr. Donovan, Birmingham, pointed out that of all the associations and institutions in the electrical industry, E.D.A. was the only one which set out to increase the sale of electricity. That was the all-pressing need of the moment. The gas industry at the Fair gave the electrical industry a lesson in advertising. It was deplorable that electricity was so backward in that respect, but he supposed that was due to inadequate financial resources.

Mr. W. A. Turnbull (Aylesbury) considered that there was very great need for showrooms in relatively small towns in country districts, and information should be forthcoming as to what would be done in that direction when the small power stations were done away with.

Mr. A. Nichols Moore (president, I.M.E.A.) said that every facility should be afforded for the display to the public of cheap and moderately priced electrical fittings.

Colonel Vignoles, replying on points raised in the discussion, said he appreciated the importance of showrooms, and places like Aylesbury should certainly have such facilities, but it was obvious that in relation to cost, each case must be considered on its merits.

Luncheon.

At the invitation of the Birmingham Chamber of Commerce the visitors attended a luncheon. The chairman was Mr. R. C. Rodgers (president of the Chamber).

Among those present were Sir Arthur Steel-Maitland (Minister of Labour), Sir Edward Crowe (Department of Overseas Trade), Sir John Gatti, and Mr. A. Nichols Moore.

Sir John Gatti, in proposing the toast of "The Electrical Industry," said a great change had come about within the recollection of many who were present in relation to the attitude of the public towards the electrical industry. In spite of disappointments and discouragements the industry had made a tremendous stride forward, and had done as well as, if not better than, any other trade. It was a very complex industry, which had to link up and work together with a number of industries. We had generating stations which compared very favourably with those in America, and the price of electricity in this country compared well with any others. In spite of the greatly increased cost of production compared with pre-war days, the electrical industry was selling at less than pre-war prices. That had been brought about by a constant desire to improve, and by a readiness to face the cost of scrapping machinery and equipment and also by constantly taking advantage of every improvement that engineers and manufacturers and the technical knowledge of the day had been able to produce. Although electricity was cheap, it had to become cheaper. He thought that they had concentrated too much on the cost of generation. The capital costs of distribution were as great, at least, as the capital costs of generation. If they were going for a unification of tariffs, they must remember that whoever drew up that tariff would have a very nice problem to solve. In conclusion, Sir John said that extraordinary as their progress had been, they could look to still further advances in the future.

The toast was responded to by Mr. A. Nichols Moore, who pointed out that the British Industries Fair was a form of intensive propaganda, and it seemed to him that the electrical industry might in that respect copy its methods. The supply side of the industry had had tremendous growth, but with regard to the other sections of the industry, he did not think one could take the same optimistic view. When the national schemes had been completed, the demand for heavy plant would probably show a diminution, and it seemed to him that it would be wise if manufacturers turned their attention to the development of the trade in relation to apparatus and fittings.

Sir Arthur Steel-Maitland congratulated the promoters of the Fair on its great success. He hoped the effect would be to increase employment, so that the only person unemployed in the country would be the Minister of Labour.

Some of the Exhibits.

A Further Instalment of Illustrated Notes.

Consolidated Pneumatic Tool Co., Ltd.

A range of standard electrical machines is exhibited by this company. Included in the display are some "Hicycle" tools—drills, reamers, sandpapering machines, &c. Increase of speed makes for greater output. High-speed d.c. motors are satisfactory within limits, but the commutator is a vulnerable part and windings are easily burned out, so that the maintenance cost is high. With a.c. the maximum speed is determined by the frequency of the supply and if this can be raised, the speed of the motor is also increased and a lighter machine can be built for the same power. This principle has been adopted in the construction of "Hicycle" tools which operate usually on a frequency of from 180 to 200 cycles. A frequency changer is necessitated but it is claimed that the increased output offsets

Fig. 24.—A "Hicycle" Sandpapering Machine.

its cost where a reasonable number of tools are in use. With high frequencies the self induction of the stator winding is so great that the current cannot rise high enough to burn it out if the rotor is stalled. The rotor itself is bar wound in some sizes; in others it is wound with bare copper so that burning out becomes impossible. Fig. 24 illustrates a sandpapering machine, one of the "Hicycle" range. This has been designed for metal-finishing operations, such as grinding, polishing and buffing of car bodies and sheet-metal work. It has a self-contained right-angle drive to the polisher head eliminating the flexible-shaft drive and equipment. It weighs only 13½ lb., the disk is 9 in. in diameter, and the speed at light load is 3,600 r.p.m.

H. H. Vivian & Co., Ltd.

This company's exhibits include solid drawn condenser tubes in full length, manufactured of ordinary 70/30 brass, Admiralty mixture, the company's special "Durable" brand, and cupro-nickel; locomotive tubes; general tubing; coils of brass and copper wire for various purposes; copper strip, tape and wire for electrical purposes; rolled brass, copper, and nickel-silver in the form of sheets and strip; and a method of using thin copper sheet for roofing.

Bureau of Information on Nickel, Ltd.

The Bureau exhibits, which include typical examples of the more important alloys of nickel and their applications, are grouped according to the type of alloy to which they belong, the main classes being:—Nickel alloy steels, nickel brass and bronze, heat-resistant alloys, nickel cast iron, nickel copper, &c., malleable nickel, and nickel-plating. One of the newest applications of ferro-nickel alloys is in the field of electrical communication, for which alloys containing about 78 per cent. nickel, the balance iron, known as "Permalloy," "Mumetal," &c., and distinguished by remarkable magnetic permeability at low intensities of the magnetic field, have been recently developed. By "loading" submarine cables with these materials and thus eliminating the attenuation and distortion of signals, it has been possible to increase the rate of cable communication from 300 to 1,500 signals per minute. The portion of cable exhibited illustrates clearly how "Permalloy" is used in this connection. Samples of "Mumetal" wire and strip, supplied by the Telegraph Construction & Maintenance Co., Ltd., are exhibited. Nickel has a very wide use as sparking plug electrodes on account of its excellent electrical and heat conductivity and its resistance to corrosive influences. A sectional sparking plug by A. C. Sphinx Sparking Plug Co., Ltd., is a good illustration of this application. Several well-known storage batteries require a substantial amount of nickel for the active chemical constituents of the cells. A large battery of this type, by Batteries, Ltd., is exhibited, while a sectional cell of another type shows clearly the method of construction. Examples of nickel-plated articles by Messrs. W. Canning and Co., Ltd., have been contributed to the nickel section. A group of alloys consisting chiefly of nickel-chromium and iron are now coming into great prominence on account of their excellent mechanical properties and strength at high temperatures (650 deg.-1,200 deg. C.) in comparison with steel or other structural materials. They have, as well, high electrical resistance combined with low temperature co-efficients. Some electrical applications are illustrated by the electrical range unit and other products which are displayed.

Hollings & Guest, Ltd.

On this stand there are shown typical examples of the company's hydraulic presses, pumps, accumulators, valves, &c. The press of greatest interest to the electrical industry is a vertical four-column model with steam-heated platens specially designed for the manufacture of insulating materials. This press is fitted with two hot plates, made of cast-iron in which the steam heating coil is cast solid in the plate, making it practically impossible for a fracture to occur at any steam pressure which may be reached. The hot plates are 15 in. square, machined on both faces, and polished on their working surfaces. The top one is firmly fixed to the press head and the bottom one is attached to the press table. "Ellmar" mouldings form another section of the display. A varied collection of moulded "Bakelite" products is on view, which are now being marketed by a subsidiary company—the Ellmar Mouldings Co. The mouldings are specially suitable for the manufacture of all kinds of insulating materials for the electrical trade, wireless parts, magneto fittings, motor-cycle and motor-car fittings, gear lever knobs, advertising novelties, &c. They are made in various colours and are not affected by oils, acids, or water.

Brook Motors, Ltd.

This company is exhibiting a.c. motors in sizes from 1 h.p. to 50 h.p., of the following types: crane, pipe-ventilated, totally-enclosed, and protected. There are also shown d.c. motors interchangeable with the a.c. motors; and special motors that the company makes for driving woodworking machinery, and motors that are built into woodworking machines to become part of the machine itself, whereby no belts or gears are required. Motors attached to pumps and fans are exhibited, particularly a fan coupled to a motor, with contactor gear so as to enable any person viewing the exhibit to start up the unit by pressing a push button. Various types of switchgear and starters are also shown. The whole of the units exhibited are wound for working on single-phase current, and there are special motors for two- and three-phase supply.

British Domestic Arts, Ltd.

The "Pellon" electric radiators which are displayed by this company are unique of their kind. Generally, they are of circular plan, and consist of a base and a domed head. In the

Fig. 25.—The "York" Radiator.

latter is a heating element, and air is drawn up through the centre of the radiator, passes over the element, and comes out at the base of the dome. The sides are so designed as to reflect the heated air towards the floor of the room. One of these radiators is illustrated in fig. 25—the "York" model. This particular pattern has a 1-kW loading. Its height is 18 in. and the diameter of the base is 12 in. It is handsomely ornamented, and is given a brass, copper or oxidised silver finish.

Wild-Barfield Electric Furnaces, Ltd.

The exhibits of this company occupy a part of the Birmingham Electric Supply Department's stand. Among them is a "Wild-Barfield" electromagnetic steel-hardening furnace (type 12 F), with a chamber measuring 23 in. long by 16½ in. wide by 6 in. high, oval shape; the power consumption is 7.9 kW maximum. This furnace is operated by a hardener from B.S.A. Tools, Ltd., which company is supplying screwing taps and dies, &c., from its works, to keep the furnace in constant operation. Another electromagnetic furnace shown (type 16 R.) has a chamber measuring 16 in. diameter by 28 in. deep and a power consumption of 11.9 kW maximum. This furnace is operated by a hardener from the Moss Gear Co., Ltd., Birmingham, who demonstrates the heat treatment of automobile gear wheels. The Imperial Enamel Co., Birmingham, is operating an internally-heated box-type furnace

Fig. 26.—A "Wild-Barfield" Electromagnetic Furnace.

(type M.F.12) with a chamber measuring 40 in. long, 24 in. wide, and 12 in. high, fitted with automatic temperature control to keep the furnace temperature constant within required limits.

A high-speed steel-hardening and preheating tempering furnace (type H.S.F.2) is also shown in operation. This furnace has a high-temperature chamber for hardening, and a preheating chamber measuring 15 in. by 6 in. by 3½ in., which, being fitted with a separate regulating resistance for hand control of temperature, can also be used for tempering after hardening, and for this purpose also a thermo-couple is fitted in the preheating chamber. Each chamber has a separate main switch and fuses, and the whole is mounted as one complete unit. In addition to the foregoing, an air-tempering muffle for tempering tools, &c., automatically, after hardening (type A.T.O.2) is shown in operation. This oven is fitted with a fan in the floor, beneath a perforated metal basket to carry the work, providing maximum efficiency of heat circulation. The furnace is supplied with automatic temperature control, which keeps the temperature constant within plus or minus 3 deg. C. This furnace and its control panels are illustrated in fig. 26. There is also a Vickers "Pyramid" diamond hardness testing cachine.

Ray Engineering Co.

This exhibit, as last year, comprises a complete range of "Ray" switchboards and switchgear. In addition there is a new type of enclosed controller for electric lighting plant, which is claimed to be absolutely "foolproof" and interlocked in all its operations. Resistance battery-charging units, automatic cut-out switches, shunt regulators and instruments are also shown, together with a sample of the company's open type power switchboards.

Gledhill-Brook Time Recorders, Ltd.

A very complete display of time-recording and cost-checking devices is made by this company. The Gledhill-Brook "Clipper" recorder is a card machine which the worker operates on arrival and departure. Every manufacturing process or operation can be timed in the same simple manner, and various systems of time checking and costing can be combined with this one machine. The company also markets other models for simple time checking of workmen or clerical staff, also for registering time or dockets, waybills, cost cards, &c. All the Gledhill-Brook models print the exact minute, hour and day.

Lacy-Hulbert & Co., Ltd.

On this stand are shown examples of the company's ball-bearing compressors especially designed for direct coupling to electric motors, petrol engines, and other high-speed prime movers. Some are shown as fixed and portable sets direct coupled to d.c. motors and petrol engines. The combinations exhibited include sets for use in garages and service stations for tire pumping, &c., and for paint spraying, operating pneumatic tools, road breaking, &c. The range includes sizes from 2½ cu. ft. to 80 cu. ft. of free air per minute for any pressure up to 150 lb. per sq. in. Other exhibits are combined electrically-driven compressors mounted on air receivers; a variety of air compressors and vacuum pumps; a portable electric air blast for cleaning electrical machinery and similar applications, also larger sets for the same purpose as used in generating stations, &c.; rotary blowers and pumps; hand pumps, &c.

Thermo Path Co., Ltd.

A number of examples of its "Meracol" electric fires are shown by this company. The distinctive design produced takes the form of a projector fire in which, it is claimed, the whole of the heating element is approximately in the focus of the reflector. The element is guarded by a metal centre-piece. Fires of this type are mounted in screens, finished and ornamented in several styles, and examples of these are shown. The company also makes bar-fires, vertical and horizontal, in which the elements are mounted on the focal line of a parabolic trough reflector. Another exhibit is a cabin heater which, although designed for use on board ship, can also be usefully employed in the home.

A-1 Electric Welding Appliances Co.

This firm manufactures electric resistance welding machines and heaters and two of its machines are shown on the Birmingham Electric Supply Department's stand. They are a spot-welding machine, and a hand-wheel-operated, automatically-controlled, butt-welding machine for welding tubes, bars, rims, and various sections, the special feature of which is that the control of the welding is automatic and independent of the skill of the operator, and allows unskilled labour to produce efficient and consistent work; and an electric rivet heater.

Moorwoods, Ltd.

An outstanding feature of this stand is the way in which two electric fires are fitted into fireplaces of the company's manufacture. In one case the fire is simply hooked on in place of the canopy. The fires themselves are very well finished in stainless steel and nickel. Examples of the company's electric radiators are also shown; these are of the "utility" type—plain but efficient. Cookers form another part of the exhibit and among them is the "Moorwood Junior," which is a small oven (12 in. by 10¾ in. by 11 in.) fitted with top and bottom elements totalling 3,000 W, each controlled by a three-heat snap switch. A special cast-iron stand is provided for this.

Rd. Johnson, Clapham & Morris, Ltd.

The exhibits on this stand, whilst including examples of many of the company's activities, are in the main confined to a range of manufactures demonstrating its position as a source of supply for bare and tinned copper conductors in rod, strip and wire, and in cotton covered and braided rod, strip, laminated strip and instrument wires in all standard sizes and finishes designed to meet the general requirements of every department of the electrical industry. "Pacem" dead flat galvanised wire netting is shown in a selection of standard sizes. Other exhibits include a wide range of examples of woven wire and wirework for the engineering and allied industries. Screening for every industrial purpose is produced.

British Electrical Repairs, Ltd.

As in previous years, this company exhibits a model vacuum and pressure impregnation plant, as used in its works at Birmingham, Glasgow, London, Manchester, Swansea, and Newcastle-on-Tyne. It is also showing coils impregnated and unimpregnated to demonstrate the advantages of vacuum and pressure impregnation. Samples of armature, stator and field coils, also magnet coils of all shapes and sizes, which the company makes to specification, appear, as well as commutators which are made in a special department of the London works.

Stuart Turner, Ltd.

Small petrol and gas engines and lighting and pumping plant are exhibited on this stand, and the latter itself is illuminated by means of a "Stuart" plant. The smallest set is a 120-W size for battery charging and cottage lighting. High-voltage as well as low-pressure batteries can be charged, as the dynamo is a double output machine—16 and 100 V. A "Type P.4" 1-b.h.p. engine is shown driving a ¼-kW dynamo. This directly-coupled lighting plant is very

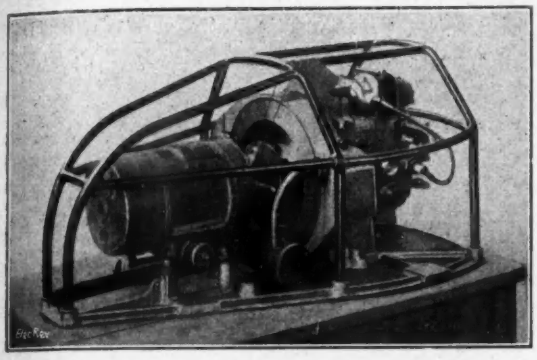


Fig. 27.—A "Stuart" Radio Supply Generator.

compact, and is suitable for the modern small country house. A useful feature is the auxiliary pump (300 gal. per hour) which can be fitted to the plant. Yacht lighting sets with circulating pumps are shown. The pump is geared down so that it runs quite slowly. The 1-h.p. engine is shown in section, so that the materials employed and method of construction and working can be clearly seen. The largest plant shown at work on the stand is a 1½-kW lighting set, driven by a 3-b.h.p. engine, whilst other exhibits include small pumping plant and a special very light weight air-cooled engine for mule pack wireless sets (fig. 27). This engine is used by the Royal Corps of Signals. The War Office has already acquired over 300 of them, and they are in use throughout the British Empire. Although solely air-cooled, they are said to function as well under the most trying tropical conditions as in England. One of the tests which each engine undergoes is a full load 6-hour run at a temperature of 140 deg. F.

Frederick Smith & Co.

The exhibits of this company exemplify the variety of wire which it produces. They include hard-drawn h.c. copper trolley wire, h.d. and soft copper wires and strip, sectional copper strip, h.d. copper strand for transmission lines, copper plating wire, silicum-bronze and cadmium-copper telephone wire, plain and steel-cored aluminium strand, &c.

Uniflo Pump Co., Ltd.

The examples of hand- and power-operated pumps shown by this company are all claimed to give constant and uniform flow. A special feature of these is that all working parts in contact with the liquid pumped are of non-ferrous metal, making the pumps suitable for hot or cold water, oil, petrol, tar, and other non-corrosive liquids. The pump can be constructed in special metals for dealing with corrosive liquids. The bottom cover can be removed very easily for inspection purposes without disturbing the pipes.

Vac-Tric, Ltd.

Various patterns of its electric vacuum cleaner are shown by this company and demonstrations are being given.

Young, Osmond & Young, Ltd.

Tubular electric heating in various forms is the subject of this company's exhibit. Among the items on view is a domestic type radiator with four bars and a low energy consumption, several towel rails, &c. The company has produced a 1,800-V heater for use on a Spanish electric railway and one for 600-V for the heating of tramcars. Another exhibit of the company is the "Satchwell" thermostat, an excellent device of its kind, which we dealt with in connection with last year's Fair.

William McGeoch & Co., Ltd.

In the switch- and fuse-gear section of this stand are patent self-aligning H.O. type fuses; Warwick type knife and ironclad switches; and unit-type switchgear. Special attention is directed to the unit-type ironclad switchboard exhibited. Examples of distribution and fuse boards are also on show. There is also a good selection of electric lighting fittings, many in modern style. The types shown are suitable for houses and public buildings, and there are others for ship use. Various types of miniature fittings for yachts, motor boats, motor omnibuses and cars, are also on view. Other special exhibits include lampholders, ship's navigation lamps and indicators, flashing lamps, direction signs, "Klidos" connection boxes, and plugs and sockets.

Rainsford & Lynes, Ltd.

A large collection of electrical accessories of all kinds has been arranged by this company. Among them are lighting fittings; pendants, bowls, electroliers, candelabra, &c., are included in this section. There are 67 different patterns of lampholders on view, covering a wide range of purposes. Examples of fuse-gear, in teak and iron cases, for from 10 to 300 A and low- and medium-pressure switchgear are also included in the display. Other exhibits are voltmeters, ammeters, valve-testers, &c.

Gramo-Radio, Ltd.

This company exhibits and demonstrates the "Concert-Grand" combined radio set and gramophone. It is designed to operate six loud speakers and the tone can be controlled within very wide limits. An "all-electric" "Coruso" gramophone (with electric motor and pick-up) is also shown.

S. G. Brown, Ltd.

Loud speakers make up the bulk of this exhibit, all the company's various designs (including the latest "Cubist" model) being represented. In addition there is a selection of the company's "Electro-megaphone" equipment. This comprises various forms of loud-speaking telephones for use mainly in noisy situations. Many of these have been supplied to the Admiralty and shipping companies and one type has been introduced on the London 'buses for communication between the driver and conductor.

Birmingham Electric Furnaces, Ltd.

One of the features of this exhibit is a full scale half section of a large "Birlec" furnace, which illustrates the method of construction and the special patented resistor arrangement employed. The heating elements in this type of furnace consist of heavy-section strip nickel-chromium having an exceptionally long life. Owing to the size it is impossible to show an example in operation at an exhibition. Photographs of some large installations are shown, these include furnaces for the annealing and general heat treatment of steel and non-ferrous metals, carburising, hardening, colour firing, &c. It is claimed that these cheapen production and improve the quality of the product.

Two standard portable "Birlec" furnaces, out of a range extending from 8 to 40 kW, are included in the exhibit. The small one, "C.P.2" (fig. 28), designed to operate on single or two-phase circuits, has a hearth 30 in. long by 16 in. wide, and is shown oil hardening steel parts. The larger model, "C.P.4A," having a maximum rating of 30 kW at 440 V, 3-phase, has a hearth 36 in. long by 24 in. wide, and is shown carburising. The portable type of furnace consists of a welded steel cylinder lined with refractory and insulating material. The hearth, however, is flat, and is covered with nickel-chromium plate. The heating elements, which consist of nickel-chromium strip, are mounted in the roof, sides and hearth, which, together with the circular construction, gives a very even distribution of heat. "Sil-o-cel" insulation is employed, ranging from

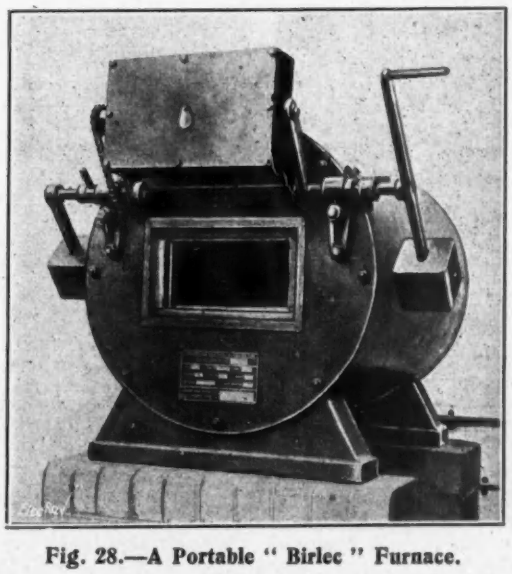


Fig. 28.—A Portable "Birlec" Furnace.

4½ in. to 9 in. thickness. The door is of a patented parallel motion type giving tight closing without clamping; opening the door cuts off the current. Automatic temperature control is fitted to all models.

Petters, Ltd.

Messrs. Petters exhibit a representative selection of oil engines and electric lighting and power plants, giving an excellent idea of their capabilities between the comprehensive range of 1½ and 600 b.h.p., and demonstrating the advantages

of the smooth-running Petter improved two-stroke cycle engine.

Possibly the most interesting exhibits are the new "T" type engine, the "PCR" engine, and the "Auto-Petter Light," an automatically-controlled electric lighting set which made its *début* at the Smithfield Show recently.

The new 25-b.h.p. Petter "Atomic Diesel" high compression airless injection, cold starting oil engine (fig. 29) is exhibited in operation, driving a 220-V generator, direct coupled. Engines of this type are now being built in a range of sizes up to 160 b.h.p. in single, twin, three and four cylinder units. The design is extremely simple, and a number of new features are incorporated. High thermal efficiency, consequent on perfect combustion, is achieved by the special design of the combustion chamber. During the latter portion of the compression stroke a high degree of turbulence is attained, and the fuel oil, which is mechanically injected into the combustion chamber in the form of a mist or atomised spray of very finely divided particles, meets the turbulent air and intimate mixture results. Ignition is caused by the temperature due to the compression pressure.

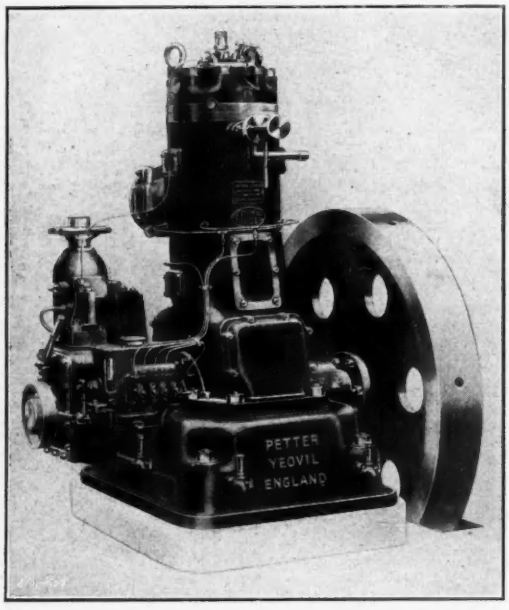


Fig. 29.—A Petter "Atomic Diesel" Engine.

The "Auto-Petter-Light" set, a compact self-contained plant without storage batteries, is a development of the company's "Petter-Light" house-lighting plant. The plant is automatically controlled and is started and stopped by hand by pressing a controlling switch placed anywhere in the house to suit the convenience of the occupier. The speed of the engine is controlled by a centrifugal governor which regulates the consumption of petrol in proportion to the number of lights in use. When electricity is no longer required the house switch can be operated, and there is no need to visit the actual installation itself. If desired additional controlling switches may be installed in any part of the house. There is no switchboard and none of the delicate control mechanism found in many automatic plants. The set consists of a two-stroke water-cooled engine fitted with a self starter similar to that on the ordinary motor car, and direct coupled to a compound wound dynamo. The plant is made in three sizes, 700, 950 and 1,450 W, 110 V, and can be supplied in other voltages if desired. Other exhibits include a 5-b.h.p. Petter "S" type engine direct-coupled to a "G.E.C." generator; a 1¼-kW "Petter-Light" electric lighting plant, and several examples of the company's larger engines.

Sturge & Baker, Ltd.

Numerous designs of electric fires are exhibited by this company. One new model is a fire with three 500-W vertical elements mounted at different angles giving a wide dispersion of heat. Another design has a slightly inclined horizontal triangular element, the reflectors being of similar shape. Miniature bowl fires and a new kind of electric bed-warmer are other exhibits.

Blackstone & Co., Ltd.

The company shows what is claimed to be the first British vertical high-speed engine to work on residual oil, the Blackstone "Spring Injection" high-speed engine. A 35-b.h.p. 4-cylinder engine is fitted in a tractor for farm and road haulage work. The engine runs normally at a speed of 1,000 r.p.m and is suited for all classes of vehicles for road haulage, locomotives, electric lighting, and other power purposes.

In addition to the tractor, a 2-cylinder high-speed engine of 17½ b.h.p., coupled to a dynamo, and a 6-cylinder, 52-b.h.p. size are exhibited. Other notable exhibits on this stand are the new "Blackstone" petrol-electric sets with outputs of from 1 to 3½ kW, and several other stationary and portable petrol engines, a range of special mills for crushing, &c., are shown. A further exhibit is the Blackstone "Unchokeable" pump for pumping liquids containing any class of solids, hard or soft.

On another stand the company has a selection of its "Spring Injection" heavy-fuel-oil engines. One, a 64-b.h.p. size, is shown, complete with dynamo and switchboard.

A new range of generating sets has recently been introduced by the company; they embody Blackstone "no trouble" petrol engines directly coupled to dynamos, with common cast-iron bases. It is claimed that the sets are simple to handle, easy and reliable to operate, and economical in running costs. Fig. 30 shows one of these sets. The sets supplied have normal outputs of 1, 1½, 2½ and 3½ kW. In each case the engine works on the four-stroke principle, has high-tension magneto ignition, and is water-cooled. It is fitted with a special patented mechanical device, which, actuated by the governor, regulates both the quantity and quality of the mixture fed to the combustion chamber, according to the load.

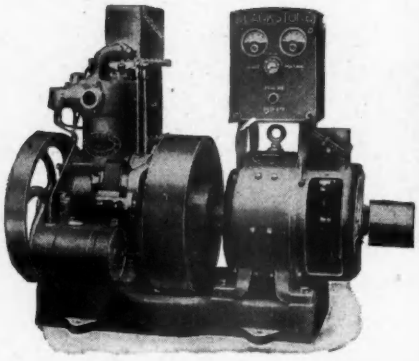


Fig. 30.—A Small "Blackstone" Generating Set.

S. Berendsen, Ltd.

The principal exhibit of this company is the "Uwana" combined four-valve radio set and gramophone, and it also shows models of portable 5-valve sets, loud speakers, &c. The "Electricon" is shown; this is a simple device consisting of a plug and socket for tapping flexible wires.

Northern Rubber Co., Ltd.

A varied display of rubber products appears on this company's stand. Among the articles of electrical interest which are shown are switchboard mats, rubber gloves, and various kinds of insulators for electrical applications.

Holman & Co. (Engineers), Ltd.

A range of "Lightning" electric shearing machines is on view on this stand. One of these, Model "A," is illustrated in fig. 31. This particular example is designed for cutting mild steel sheets up to 14 s.w.g. or correspondingly thicker sheets of brass, copper, aluminium, &c. The motor has a power consumption of 250 W, and the net weight is only 41 lb. Models "B" and "D" are also shown; these are for larger work, and the motors drive through belting. Both are equipped with 3-h.p. motors and are capable of dealing with mild steel sheets up to 8 s.w.g.

Fig. 31.—A "Lightning" Shearing Machine.

Castle Fuse and Engineering Co., Ltd.

The principal exhibit upon this stand is a three-unit fuse assembly. This has a cast-iron distribution box with removeable panels on each side and a lid with machined face, and spring-loaded hinges, which ensure a gas-tight joint. The patented divided bus-bar combines the function of bus-bar and support bar. The fuse unit is of "Triumph" patented design with a special clamping arrangement so that any size of fuse from 60 to 350 A may be readily attached to the bus-bar. The

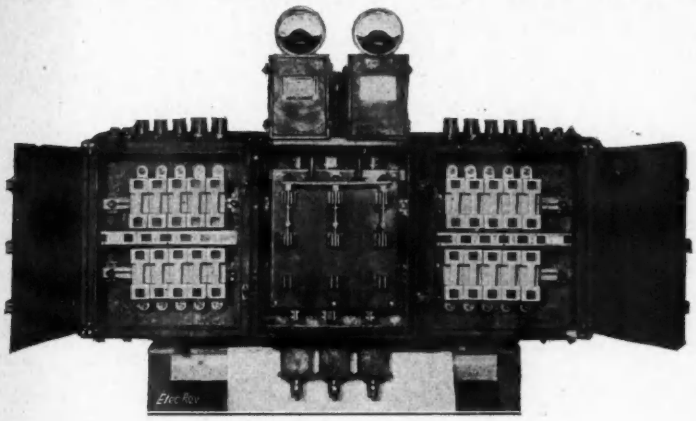


Fig. 32.—Three-unit Fuse Equipment.

switch box is fitted with a removable back and side plates; it houses a switch panel carrying a 1,000-A triple-pole change-over switch. Sealing chambers and glands for two sets of incoming mains, and adjustable cable connectors are provided, and there is an arrangement which prevents compound from leaking from the sealing chamber due to hydrostatic pressure. The top section cover has a hinged lid, which fits on the front of the switch box, enclosing the switch panel and mechanism in a gas-tight box, and it is of sufficient depth to enable the switch blades to be left in any position with the lid closed. The metering equipment is mounted on the top of the upper section of the switch box, and the ampere-hour meter is contained in a cast-iron case with hinged front and a glass window.

The divided bus-bar, mentioned above, can be used for all power fuses in sizes from 60 to 350 A. Outgoing circuit strap connections of a flexible nature are provided, with sweating lugs, and are of such a length that all the cable lugs are brought into line for the various sizes of fuse. A loose plug can be attached to the lug for short-circuiting any fuse unit. Brass clamping plates, with flexible straps, form the interconnections between the switch box and the distribution box, or between two distribution boxes. A short-circuiting socket is provided on the top.

The company also shows a balanced 3-wire service distribution box having four 60-A ways, switch and metering equipment; a 2-wire service distribution box with eight 60-A ways; two new larger unit boxes with removable panels, for 3-phase distribution or to house circuit breakers; a feeder pillar, incorporating several new features, ironclad fuseboards, &c.

Henry Wiggin & Co., Ltd.

Among this company's exhibits are electric fires of various makes fitted with "Brightray" elements; a range of sample reels of "Brightray" and "Glowray," both nickel-chromium electrical resistance-wires; "Ferry" for motor starters, &c.; various small resistances and rheostats; and photographs of heavy electrical equipment using the company's resistance materials.

Flextol Engineering Co., Ltd.

Tools for many applications are shown upon this stand. They include drills, grinders, riveters, polishers, &c., many of which are electrically driven through long flexible shafts.

Exhibits at the White City.

The exhibits at the White City (London) Section of the Fair are confined to the lighter trades, these being divided into nineteen different groups, the floor area occupied having increased from 257,700 sq. ft. in 1928 to over 317,000 sq. ft. on the present occasion. There is about eight miles of stand frontage, while to provide for the lighting 32 miles of cable, and about 30 miles of flex have been installed. There is no special electrical section, apart from that devoted to radio apparatus, but exhibits of an electrical or cognate character are to be found in the majority of the groups, cropping up in many unexpected places. Notes on some of the stands follow:—

Accurate Recording Instrument Co., Ltd.

Some very interesting examples of distance recording and indicating thermometers and pyrometers are to be seen at this stand. Although the majority of these work on the vapour-tension principle, some thermo-electric and other instruments are shown as well as "Reid" sparking plugs, in which the working spark is visible from the exterior.

Ajax, Ltd.

The "Sunviray" ultra-violet ray apparatus is shown on this stand in a variety of sizes, ranging from a hospital appliance capable of treating as many as 600 patients in an hour down to a well-designed set for home use. Equipment for dental and veterinary purposes is also on view, while several electrically-operated appliances for use in ladies' hairdressing establishments are also shown.

Bower Electric (1926), Ltd.

A full range of "Uvral" ultra-violet ray instruments for electro-medical treatment is to be seen at this stand, the apparatus on view ranging from a set designed for hospital use to a new domestic twin-arc model. The latter is adapted to be worked off an ordinary house lighting circuit, and is fitted with two resistance units incorporated with a reflector. The apparatus is also so arranged that it can either stand on a table or be hung on a wall. The larger instruments are fitted with a special time-control device known as an "expometer," which automatically cuts off the current at the end of a predetermined period. High-frequency and diathermy radiant heat appliances are also displayed.

At this stand is also to be seen a novel illuminated advertising sign known as the "Neosyne." The lighting effect is obtained by a neon tube, but in this case the tube is not made in special lettering form, but in parallel lines. The tube is mounted in a metal frame adapted also to receive a stencil cut with special lettering or design, the light only showing through the cut portion of the stencil. One special advantage of the arrangement is that the message given out by the sign can be changed as often as desired at the cost only of the additional stencils.

J. A. Brook.

A device for locking electric lamps with a special key in the form of a spanner is exhibited at this stand. The device, which is made in forms suitable for different types of lampholders, is now being widely used in many works and Government Departments. At this stand is also to be seen in operation Brook's super-sparker, an ingenious device adapted to be fitted on the dashboard of motor vehicles to give a visual indication of the regular or irregular running of the magneto or the sparking plugs.

Burovox, Ltd.

This company is again demonstrating its "Burovox" loud-speaking telephones for use in offices, works, mines, ships and noisy engine rooms. The marine patterns include both portable and bridge pedestal types, in which the loud-speaker and microphone are housed in non-corrosive aluminium waterproof hoods.

I. Calvete, Ltd.

This firm occupies a large stand, and has a complete display of electro-medical appliances, including the "Solart" ultra-violet and "Icalite" radiant-heat lamps which are made in a variety of sizes ranging from hospital apparatus to a small portable appliance. Other specialities shown include the "Everay" h.f. massaging apparatus, electric hair dryers, clippers, and curling iron heating stoves, for hairdressing establishments; a new series of "Thermical" diathermy apparatus; and an "Icall" pedestal combination provided with attachments for vibro-massage, hair-cutting, manicure and chiropody.

A. C. Cossor, Ltd.

In addition to a full range of radio valves and receiving set components, this firm is showing "Cossor" electric lamps for motor vehicle lighting, and the "Empire" and "Imperial" h.f. generators for electro-medical purposes. Of special interest to power supply undertakings are the "Cossor" vacuum detectors for carrying out tests of circuits at pressures of from 1,000 to 15,000 V. Three sizes of portable detectors are made. The detector itself is mounted in a stout glass tube surrounded by a protecting insulating sheath. One end terminates in an aluminium cap and the other is attached to a long insulated handle, which, for convenience of transport, is made in three pieces. A 10-ft. length of highly insulated flex is provided for earthing one end of the tube. A switchboard type of detector is also made, the detector tube in this case being enclosed in a cast-iron case and mounted on porcelain insulators which are prolonged outside the case so as to pass right through the switchboard panel.

Dakol Electric, Ltd.

This exhibit comprises a number of electric lamps embodying the "Dakol" blue glass screen and special diffusing screen which, used in conjunction with gasfilled lamps, is claimed to give an artificial light closely approximating that of daylight. The effect of the screens is to cut out the yellow rays of the light and at the same time emphasise the blue and violet rays, a restful light without any dazzle resulting. The system is shown as applied to pendant globes and bowls, wall brackets, table and desk standards, and also for use in connection with microscope work. It is also being largely used in establishments where much colour matching work has to be done.

Electric Drives, Ltd.

In view of the increasing use of small fractional h.p. motors for operating sewing machines, gramophones, and small tools generally much interest is being taken in the display of "Eldrive" universal motors shown by this company. The motors, which can be operated by either a.c. or d.c., are made in sizes ranging from ¼ to 1/100 h.p., to run at speeds of 2,000 and 4,000 r.p.m. The company makes a foot-operated starting switch and speed regulator for use in connection with the motors.

Thermaga, Ltd.

"Thermaga" electrically-heated pads for human body local heating and also bed blankets are again being exhibited by this firm. The pads are suitable for use with any voltage between 100 and 250, and are supplied for either a single temperature or with a three-heat switch.

Hailwood & Ackroyd, Ltd.

Among a wide range of illuminating glassware and fittings to be seen at this stand are examples of special electric pendants and globes made by the firm from the designs of Sir Frank Baines, for use in the large new London offices of Imperial Chemical Industries, Ltd. Another interesting exhibit is an electric table lamp for use in the boardroom at the same offices, the shade taking the form of a globe built up of three layers of respectively frosted, opaque white, and red glass, the layers being so cut away as to form a map of the world, with British possessions standing out in red. Samples of "Hailuxo" heat-resisting glass and of metal stampings and pressings for use in pendants and wall brackets are also shown.

British Insulated Cables, Ltd.

This company exhibits examples of its "Prescot" electric rivet heaters and welders. The former embody a single-phase transformer for converting a.c. of standard voltage to the large current necessary for heating rivets. The machines are made in several sizes ranging from 10 to 50 kW, and it is claimed that the 10-kW machine will heat 70 lb. of rivets per hour, and that it be used continuously without overheating. The welding machines shown comprise Prescot electric spot and seam welders for wrought iron, mild steel, brass or aluminium. Like the rivet heaters, these are all made in various sizes, and are designed for use with single-phase a.c.

Premier Electric Welding Co., Ltd.

This company also shows a typical electric welding machine together with specimens of "Premier" and "Belfinish" welding electrodes.

Marconi's Wireless Telegraph Co., Ltd.

In the Wood Lane entrance hall this company has a joint exhibit with the Eastern Telegraph Co., Ltd., consisting of a number of instruments used in connection with wireless telegraphy. Among the apparatus shown is a "Jell" perforator and transmitter operated by a keyboard similar to that of a typewriter, and a Marconi high-speed recorder.

T. & F. Mercer.

This firm is showing several examples of the "Octo" synchronised electric clocks, the types on view including a series specially adapted for marine time-keeping. Interest is also being shown in the improved "Holden" recording chronograph for the electric timing of motor speed trials and races.

George Nobbs, Ltd.

The "Genii" electric tubular heaters for the heating of rooms, cupboards, &c., occupy a prominent position on this company's stand. The heaters are made up in lengths of from 2 to 17 ft. to consume from 25 up to 70 watts per foot run. The outer tubes are made of seamless steel tubing enclosing a mica element without coils so arranged that it can be easily withdrawn for examination or renewal; the elements are bolted together in short sectional strips. The firm is also showing a range of "Genii" electric immersion heaters which are made in single-, double- and four-bladed patterns, and in capacities from 100 to 9,000 W. Also shown is a range of the "Genii-MacLaren" thermostats for regulating water heaters, boilers, furnaces, incubators, &c.

Peerless Electrical Manufacturing Co., Ltd.

This concern specialises in the manufacture of electrically-operated appliances for tradesmen's use. A number of different machines are displayed, among them being a cake-mixing machine for confectioners, and a mincing and sausage-making machine for butchers. The various appliances are driven by small ball-bearing electric motors which, like the gearing, are entirely enclosed, starting and stopping being effected by a flush-type push button.

Sun-Vi-Lite, Ltd.

This is another company specialising in electro-medical equipment, which includes the "Vilite" ultra-violet ray appliances ranging in size from those designed for hospital use down to a domestic set embodying two polished circular reflectors arranged one above the other, one housing semi-automatic twin-arc mechanism, and the other an infra-red element which also acts as the arc resistance. Also displayed is the "Viliteometer" exposure unit consisting of a small rectangular box containing mechanism for automatically controlling the period of exposure in ultra-violet ray apparatus.

Synchronome Co., Ltd.

Various patterns of "Synchronome" electro-magnetically operated clocks are shown by this company. The current for the working of the clocks is supplied from dry cells, and an electric bell is incorporated in the circuit in such a way that it comes into action when the cells tend to become exhausted, so giving a warning for their replacement.

Fuller Accumulator Co. (1926), Ltd.

On a large stand this company shows a full range of accumulators for radio purposes as well as for central station and house lighting use, and train and motor vehicle lighting, and block accumulators for telephone, telegraph, and railway signalling work. Attention is also drawn to the "Fuller" unspillable accumulators, dry batteries, and the "Sparta" loud speakers.

Ernest Turner.

Some examples of highly-finished galvanometers, ammeters, micro-ammeters, voltmeters and other electrical measuring instruments attract attention at this stand. Appliances are made for all classes of work from small instruments for use with radio sets to those for power stations.

The Canadian Section.

Among the exhibits of an electrical character in the Canadian Section are the "Beatty" combined domestic electric washing and wringing machines handled in this country by Beatty Bros., Ltd. The machine comprises a round copper tub containing a three-armed reversing agitator driven through gearing by a 1/6th-h.p. motor mounted below. The agitator driving gear is also connected to the wringer, which is provided with a quick release. Another domestic electric washer, wringer and ironer hailing from Canada, is the "Locomotive" made by the Brantwood Washing Machine Co., Ltd., and shown by the Sloan Electrical Co., Ltd. This machine also appeared at Birmingham and is described in that section of our notes.

Messrs. Nathan & Allen, Ltd., display several examples of electric "rangettes" and hot-plates made by the Tudhope Metal Specialities Co., of Orillia, Ontario. These are light, compact and artistically-finished cooking appliances made in single, double and triple heating element form. The single hot-plate element has a loading of 660 W, the twin element sets are of 600 W each, while the largest size has two of 600 W and one of 1,200 W on a lower shelf. With the larger sizes an oven is supplied, this being detachable so that it can be placed over either one or two elements. The outfits are each fitted with a three-heat switch, and the fittings, being chromium-plated, are untarnishing.

Hoover, Ltd., show examples of its well-known suction cleaners and floor polishers. The Monarch Battery Manufacturing Co., Ltd., of Kingston, Ontario, displays a range of secondary batteries suitable for radio, motor vehicle, house-lighting, and central station use. The Northern Aluminium Co., Ltd., represented in this country by Aluminium II, Ltd., exhibits examples of various aluminium products, including power transmission cables.

Electrical Exports of Germany.

Figures for 1927 and 1928 Compared.

THE following statistics showing the value (in thousands of Reichsmarks), weight in double centner (equals 220 lb.), and in some instances the number of pieces, of electrical apparatus exported from Germany in 1928 are based on the official foreign trade returns of that country. The figures for 1927 are added for purposes of comparison, and notes of increases and decreases are made. For both years the totals include exports on reparation account. With regard to the destination of the exports of dynamos, motors, convertors, and transformers, Argentina, Holland, Denmark, Sweden (and Great Britain in the smaller sizes), figure prominently amongst the destinations of machines up to 150 kg. in weight; Russia, France, Argentina, and Brazil were good customers for those from 150 kg. to 3,000 kg., whilst of those over 3,000 kg. 69 went to Argentina, 63 to Spain, 508 to Russia, 36 to Norway and 37 to Japan, during last year.

	1927.	1928.	Inc. or dec.
Electric lighting and starting apparatus for motor vehicles—			
Value	5,710	6,942	+ 1,232
Number	65,954	80,307	+ 14,353
(Double centner)	5,034	6,904	+ 1,870
To Czecho-Slovakia ,,	17,358	18,952	+ 1,594
,, Austria ,,	13,463	16,741	+ 3,278
,, Italy ,,	8,936	12,797	+ 3,861
Dynamos, motors, convertors and transformers up to 5d.-centner—			
Value	27,007	35,624	+ 8,617
Number	512,661	610,719	+ 98,058
(Double centner)	86,845	103,017	+ 16,172
Ditto, from 5 to 30 d.-centner—			
Value	17,707	17,698	− 9
Number	7,642	7,289	− 353
(Double centner)	79,125	78,653	− 472
Ditto, over 30 d.-centner—			
Value	15,070	21,249	+ 6,179
Number	957	1,274	+ 317
(Double centner)	86,206	119,010	+ 32,804
Armatures and commutators—			
Value	6,650	9,338	+ 2,688
(Double centner)	15,387	26,182	+ 10,795
Accumulators, plates, &c.—			
Value	8,165	7,841	− 324
(Double centner)	44,919	44,209	− 710
To Denmark ,,	9,111	5,174	− 3,937
,, Finland ,,	1,682	5,332	+ 3,650
,, Holland ,,	9,497	10,080	+ 583
,, Sweden ,,	8,871	7,235	− 1,636
,, Argentina ,,	1,942	2,723	+ 781
Electric cable—			
Value	40,662	47,127	+ 6,465
(Double centner)	425,956	490,395	+ 64,439
To Denmark ,,	*	2,796	—
,, Gt. Britain ,,	13,082	*	—
,, Holland ,,	133,254	93,282	− 39,972
,, Norway ,,	9,058	16,469	+ 7,411
,, Sweden ,,	19,326	29,150	+ 9,824
,, Poland ,,	11,600	10,120	− 1,480
,, Argentina ,,	59,645	88,300	+ 28,655
,, Japan ,,	4,825	21,900	+ 17,075
,, Finland ,,	15,249	27,500	+ 12,251
,, France ,,	8,000	44,000	+ 36,000
Arc, mercury, quartz, &c., lamps—			
Value	2,734	3,375	+ 641
Number	19,648	32,037	+ 12,389
(Double centner)	2,189	2,807	+ 618
To Gt. Britain ,,	1,020	3,700	+ 2,680
,, Russia ,,	1,600	2,500	+ 900
,, Sweden ,,	3,700	5,100	+ 1,400
Measuring and recording instruments—			
Value	32,936	37,597	+ 4,661
(Double centner)	28,210	29,235	+ 1,025
To Gt. Britain ,,	1,871	1,770	− 101
,, Italy ,,	3,309	3,290	− 19
,, Holland ,,	2,634	2,640	+ 6
,, Russia ,,	2,281	3,050	+ 769
,, Sweden ,,	1,644	1,600	− 44
,, Spain ,,	1,438	1,270	− 168
,, Czecho-Slovakia ,,	1,062	1,160	+ 98
,, Japan ,,	1,274	1,080	− 194
,, Argentina ,,	2,256	1,700	− 556
Metal filament lamps—			
Value	25,893	33,861	+ 7,968
(Hundreds)	554,392	689,856	+135,464
(Double centner)	10,257	12,964	+ 2,707
To Denmark ,,	30,533	36,250	+ 5,717
,, Finland ,,	12,331	16,950	+ 4,619
,, France ,,	10,700	22,070	+ 11,370
,, Gt. Britain ,,	73,606	84,300	+ 10,694
,, Italy ,,	44,462	64,950	+ 19,488
,, Norway ,,	14,723	15,360	+ 637
,, Mexico ,,	12,624	21,400	+ 8,776
,, Sweden ,,	34,721	38,100	+ 3,379
,, Switzerland ,,	11,787	20,500	+ 8,713
,, Czecho-Slovakia ,,	33,098	42,400	+ 9,312
,, China ,,	14,370	23,000	+ 8,630
,, Argentina ,,	26,187	32,050	+ 5,863
,, Brazil ,,	*	18,400	—
Telephone material—			
Value	21,825	27,493	+ 5,668
(Double centner)	11,839	15,615	+ 3,776
To Holland ,,	1,084	2,640	+ 1,556
,, Switzerland ,,	504	780	+ 276
,, Japan ,,	723	960	+ 237
,, Italy ,,	2,508	2,200	− 308
Wireless material—			
Value	41,983	49,348	+ 7,365
(Double centner)	35,412	42,796	+ 7,384
To Denmark ,,	3,160	4,050	+ 890
,, Gt. Britain ,,	10,795	10,700	− 95
,, Holland ,,	3,162	4,500	+ 1,338
,, Sweden ,,	2,711	2,500	− 211
,, Japan ,,	200	700	+ 500
,, Argentina ,,	1,171	2,200	+ 29
Electric irons—			
Value	1,409	1,471	+ 62
Electric heating and cooking apparatus—			
Value	5,946	8,346	+ 2,400
Ignition apparatus, other than magnetos, and accessories for motor vehicles—			
Value	16,874	20,101	+ 3,227
(Double centner)	13,525	18,746	+ 5,221
To Great Britain ,,	726	1,270	+ 544
,, Italy ,,	751	1,400	+ 649
,, Holland ,,	960	770	− 190
,, Czecho-Slovakia ,,	1,117	1,500	+ 383
,, United States ,,	3,685	4,800	+ 1,115
Electric safety and signalling apparatus—			
Value	5,765	7,594	+ 1,829
(Double centner)	9,419	11,535	+ 2,116
To Denmark ,,	292	750	+ 458
,, Great Britain ,,	3,864	3,860	− 4
,, Italy ,,	283	450	+ 167
,, Holland ,,	1,147	960	− 187
Electrical apparatus for lighting, power transmission, electrolysis, resistances, &c.—			
Value	85,381	111,877	+ 26,496
(Double centner)	242,394	312,089	+ 70,695
To Finland ,,	9,129	8,500	− 629
,, Great Britain ,,	18,809	21,300	+ 2,491
,, Holland ,,	29,511	33,900	+ 4,389
,, Austria ,,	12,705	11,700	− 1,005
,, Russia ,,	22,622	42,400	+ 19,778
,, Sweden ,,	13,389	17,800	+ 4,411
,, Dutch East Indies ,,	11,372	9,700	− 1,672
,, Argentina ,,	15,115	16,800	+ 685
Electro-medical and dental apparatus—			
Value	16,000	19,500	+ 3,500
Galvanic batteries and parts and heating elements—			
Value	13,093	12,340	− 753
(Double centner)	63,734	60,841	− 2,893
To Great Britain ,,	36,371	30,500	− 5,871
,, Holland ,,	5,643	4,400	− 1,243
,, Sweden ,,	5,764	6,200	+ 436
Insulating material of asbestos, mica, and micanite—			
Value	569	601	+ 32
(Double centner)	612	552	− 60

* Figures not available.

	1927.	1928.	Inc. or dec.
Telegraph or telephone insulators—			
Value	7,097	6,270	− 827
(Double centner)	67,238	61,349	− 5,889
To Russia ,,	7,054	4,800	− 2,254
,, Switzerland ,,	5,803	6,500	+ 697
,, India ,,	4,937	2,500	− 2,437
,, Dutch East Indies ,,	4,106	3,800	+ 306
,, Irish Free State ,,	4,145	4,850	+ 705
Carbon brushes, microphone carbons, &c.—			
Value	1,768	1,920	+ 152
(Double centner)	660	791	+ 131
Arc lamp carbons—			
Value	1,768	1,920	− 152
(Double centner)	6,836	6,844	+ 8
Electrodes—			
Value	7,942	9,819	+ 1,877
(Double centner)	207,837	275,753	+ 67,916

The total value of the imports in 1928 of electrotechnical products was 488,689,000 marks, as against 398,716,000 marks in 1927, while that of imports was 45,635,000 marks, against 33,462,000 marks. There were, however, some alterations in the method of compilation in October and November, 1928, which render these comparisons not quite exact.

A Large Turbo-set Contract.

A 20,000-kW turbo-alternator was recently shipped to Japan by the British Thomson-Houston Co., Ltd.

AMONG recent important contracts that have been secured by manufacturers in this country for the supply of electrical equipment abroad is that for a large turbo-alternator set made by the British Thomson-Houston Co., Ltd., for the Imperial Government Railways of Japan, through Messrs. Mitsui & Co., Ltd. This machine, which is shown in fig. 1 as it appeared on the test bed in the B.T.H. works, has some interesting features. Designed to meet special overload requirements, the turbine is of the two-cylinder type with 25 stages, suitable for steam conditions of 350 lb. per sq. in. and 700 deg. F., with a vacuum at 25 per cent. overload of 28 in. with the barometer at 30 in. The normal speed of the machine is 1,500 r.p.m., and the normal rated output is 20,000 kW, 6,600 volts, three-phase, 50 cycles, at 90 per cent. power factor.

The transport of the set presented some difficult problems which were successfully overcome. The machine was shipped from Liverpool by the S.S. *Keemun*, of the Blue Funnel line (Messrs. Alfred Holt & Co., Ltd.), and for transport from Rugby to the docks over 20 railway wagons, including several specially constructed vehicles, and 10 Scammell road vehicles were brought into use; the total weight shipped was about 400 tons. The London, Midland & Scottish Railway Company arranged a special running schedule for its train, as several of the parts were considerably over-gauge, and it is interesting to note that only five days elapsed between the first dispatch from Rugby and the stowage on board the S.S. *Keemun* of the whole set.

Fig. 1.—20,000-kW Turbo-Alternator on Test at the B.T.H. Works.

Fig. 2.—Dock Crane Lifting 50-ton Stator.

The weight of the low-pressure steam rotor, circular boarded and with skids ready for shipment, was over 17 tons, the dimensions being 16 ft. by 10.5 ft. by 10.6 ft. The railway gauge was thus exceeded by 9 in. on either side. The alternator stator weighed 50 tons 7 cwt., and measured 14 ft. by 10.5 ft. by 10 ft., and was therefore 8½ inches over gauge on either side. The stator is shown in fig. 2 being lifted by the Mersey Docks and Harbour Board's 200-ton floating mammoth crane at Birkenhead. Although not notable on account of its weight, the bottom half of the exhaust casing, which weighed 30 tons 10 cwt., was somewhat awkward to transport because of its shape, size, and unbalance, and special guying arrangements had to be made to lower it into the ship's hold. The turbine top half of the exhaust casing weighed 12 tons, boarded, and was 4 in. over gauge; it measured 15 ft. by 9.6 ft. by 8 ft.

Messrs. Southern Roadways, Ltd., of Birmingham, were responsible for the transport of the various pieces which passed by road, the largest piece being the alternator rotor, which weighed 28 tons 6 cwt., boarded, and measured 22 by 5 by 6 ft., approximately.

Illuminated Road Marking.

According to the *Daily Telegraph* the Paddington Works Committee has recommended to the Borough Council that a "white line" 25 ft. to 30 ft. in length at the junction of Bayswater Road and Edgware Road be electrically illuminated. The Ministry of Transport has received an offer from a company to install illuminated road marking as an experiment, and has asked the Council to grant the necessary facilities.

Voice-frequency Telegraphy.

Brief notes on the five systems that have been developed, and some account of the research work carried out by the British Post Office.

By W. CRUICKSHANK, M.I.E.E.

(*Extracts from a Paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

IN the tone- or audio-frequency system the signals are made up of trains of a.c. impulses, the frequencies of which fall within the range of sounds uttered by the voice and audible to the human ear. Incidentally, the amplitude of the electromotive forces impressed on the line and the resultant currents are of the same order as those used in the electrical transmission of speech by means of telephone lines.

The best line from a telegraph transmission standpoint is an aerial copper line, well insulated and free from inductive interference, but such lines are not immune from the effects of gales and snowstorms, which fact, combined with difficulties in large towns and the growth of electrical power distribution by overhead lines, has driven most of the main telegraph circuits underground. The first result of a change-over is either a reduction in the speed of working, or an inordinate and uneconomical increase in the number of repeater stations. Concurrently with the change-over in this country, which has been taking place during the last 30 to 40 years, there has been developed an elaborate system of machine printing telegraphs which has almost entirely supplanted the high-speed Wheatstone service formerly worked on main routes. Baudot multiplex systems, giving as many as six duplex channels on a single wire, or pair, and printing direct in Roman characters on a tape, possess many advantages over high-speed morse, and although the operating costs are admittedly high, the British system to-day compares very favourably with that of other countries, whether State-owned or run by operating companies. This claim is put forward advisedly, because it might appear that this country has lagged behind others in the development of new methods of communication.

Even before the close of the war a start had been made with the manufacture and laying of multiple cables with small-gauge conductors, loaded and worked with valve repeaters, to extend the main backbone trunk network. The necessity for a stable and reliable service between all industrial centres has compelled the Department to place telegraph circuits in cables which are not wholly used for telegraph purposes, and at the moment the channels of communication are more than sufficient to cope with the traffic. In Germany, on the other hand, an entirely new cable network had to be laid down after the war and it was highly desirable that it should be used in the most efficient manner for both telephone and telegraph purposes. Operation of telegraph circuits by d.c. methods, using voltages as high as 120 volts on both sides of earth potential and currents of some 30 mA, would introduce a serious disturbing influence in even a carefully balanced telephone cable, and cross-fire and cross-talk of considerable magnitude might ensue. Messrs. Siemens & Halske, closely associated with the Reichpost Administration, have developed an a.c. multiplex telegraph system which is admirably suited for operation in a telephone cable and is extremely economical in its demands for pairs in the cable. In the United States a system based on the same broad general principles has been produced independently by the Western Electric Co. to meet the demands for telegraph circuits, public and private, in the cable routes of the Bell system. The long distances between large towns on the American Continent have fostered the telegraph habit in the States, and the administrating companies make the most of long cable routes, which have involved considerable capital expenditure in their erection. Elaborate terminal and intermediate apparatus form but a small fraction of the first cost and standing charges on these cables, and it pays to superpose or composite telegraph circuits on telephone pairs. When a pair is reserved entirely for telegraphs the company sees that as many channels as possible are packed on to it. Successful operation of 12 channels, each carrying a start-stop printing telegraph, has been achieved on many important routes, giving an overall speed of some 480 to 600 printed words per minute on the single pair of wires. Since the frequencies used are kept within the audio spectrum, telephone repeaters function as efficiently on the multiplex telegraph pair as on the telephone circuits, and the interference between the telegraph and the telephone is no greater than that between telephone pairs themselves.

*Siemens and Halske System.**—The design installed in this country between London and Manchester provides six sending channels for operating in one direction on a pair of wires, and six receiving channels on another pair. Double-current working incoming to the instrument rooms is secured in the ordinary way and at the *sending ends* six 3-electrode valves, the anodes and grids of which are magnetically coupled, generate the oscillations for the six channels.

The telegraph sending relays (50 ohms+50 ohms) are capable of repeating Wheatstone signals at 150 words per minute with 36 mA; the receiving relays (500 ohms+500 ohms) under the same conditions use 4 mA. They are, however, difficult to adjust, due mainly to the alignment of the cores and to the lack of control by the adjusting screw on the armature. The amplifying and rectifying valves are of the 2-grid type. The workmanship and finish of the valves sent over to this country with the sets are of a very high-class character. After initial runs the following allocation of the channels was decided upon, with a telephone repeater at Derby :—

	Equivalent Wheatstone speed w.p.m.
Channel (1) Teletype (Stock Exchange)	45
Channel (2) Morse key (Stock Exchange)	40
Channel (3) Baudot quad, auto	90-100
Channel (4) Bolton key circuit	30
Channel (5) Creed circuit (news)	100
Channel (6) Western Electric multiplex	100

The trials on the auto Baudot were successful, but owing to the lengthy propagation time of the loaded circuit the receiving plate had to be retarded four or five segments and the receiving brush put as far back as possible. The Western Electric multiplex was working at its limit and the channel did not give sufficient margin for the commercial operation of this apparatus. The Teletype and Creed channels were quite satisfactory.

Western Electric Co.'s System.—It is suitable for application on a larger scale than the German arrangement. In a large office the production of frequencies by an oscillating valve for each channel (Americans operate as many as 12 channels per circuit) would become a serious business. An inductor alternator supplies 40 mA at a terminal voltage for each frequency of about 0.7 volt at full load. A spare machine is installed as a stand-by and the driving motor is run from the standard 24-volt battery which also supplies current to the two field coils of the alternator which are common throughout the stator. The rotor is made up of 12 soft-iron disks mounted and spaced evenly on a common shaft. Slots are cut round the peripheries of the disks, the number on each disk being determined by the frequency required. Winding slots are cut correspondingly on the pole arcs of the stator to take the stator coils which are brought out to the various frequency circuits. The flux in any stator tooth is a maximum when a disk tooth is opposite, and a minimum when a slot is opposite.

At the sending end the machine normally runs on resistance loads which are closed through the armatures and spacing stops of the sending relays. Beyond these short-circuits are connected in each case non-reactive resistances in series and in shunt; across the shunts are the individual band-pass sending filters which lead to the common input transformer of the sending repeater. Signals from the instrument room open the short-circuits on the sending-relay contacts and a.c. passes through the sending filters. The frequencies used are multiples of 85, beginning with the fifth, *i.e.*, 425, and going up in steps of 170.

At the receiving end the output transformer of the home repeater is commoned on to the receiving filters, which are closed on potentiometers for individual adjustments. The alternating currents are first amplified and then rectified, the receiving relays being connected directly in the anode circuits of the rectifying valves, with bypass condensers across their coils.

To convert a 4-wire telephone circuit for voice-frequency telegraphy, the terminal hybrid coils and balances are disconnected from the two pairs and the telegraph senders connected to one pair and the telegraph receivers to the other pair. The 4-wire repeaters along the cable function as before.

In a demonstration given at Woolwich in April, 1928, apparatus was joined to a line to Derby and back, equal to some 300 miles of normally-loaded circuit. Six channels in each direction were fitted, five with Morkrum-Teletypes and the sixth with Wheatstone in one direction and Teletype in the other: 90 words per minute speed could be demonstrated on any desired channel.

A Japanese System.—A 4-channel system was successfully designed by Messrs. T. Horie and H. Sugiura several years ago, but the apparatus and results of the trials were com-

* See ELEC. REV., March 18th, 1927, p. 421.

pletely destroyed during the earthquake of 1923. Since then the apparatus has been reconstructed, and the frequencies used are 500, 700, 900 and 1,100 cycles, generated by thermionic valves with tuned anode and grid coupling. The sending keys are connected in circuit with the output coils of the several oscillators, and each output circuit is closed on a resonant circuit, individual to itself, but all are joined in series and connected to the secondary winding of a 10 : 1 line transformer. On an artificial line of 25 standard miles, Wheatstone signals corresponding to 110 words per minute in English were successfully transmitted without using a sending amplifier. Receiving filters of two stages, designed to transmit a band of 200 cycles for each channel, were connected in parallel to the receiving-line transformer. Rectifying valves, with P.O. standard relays connected directly in their anode circuits, were utilised as receivers, the h.t. battery and relay being shunted by a condenser of about 2 μF. These results are quite remarkable when it is considered that neither sending nor receiving amplifiers were used, but no information is available about trials on working lines.

General Electric Co.'s System.—This was developed at Wembley and Stoke with the co-operation of the Post Office; valve-driven tuning-forks are used as sources of alternating e.m.f.'s. The component parts, including anode, grid and pick-up coils, polarising electromagnet and tuning condensers are assembled on the fork mounting and wired to two telephone pin plugs, so that the entire unit can be readily changed. The mountings are fitted on horizontal shelves on the back of the assembly racks and are enclosed in soundproof covers. The frequencies used are the same as those of the German system, ω increasing from 2,500 in steps of 1,500.

The installation is working between London and Leeds on two pairs in the London-Derby cable; 20-lb. conductors, loaded with 78-mH coils at 2,000 yards spacing, are used; there are repeaters at London, Fenny Stratford, Derby and Leeds, and Wheatstone signals were successfully transmitted on all six channels at 100 words per minute. Perfect signals were printed on Creed apparatus on all arms at this speed.

A French System.—The S.E.L.T. system is a duplex one, four channels being used in each direction on a loaded pair of wires. The frequencies used are ω=5,000, 7,000, 9,000 and 11,000 in one direction and 6,000, 8,000, 10,000 and 12,000 in the other. The line is balanced in a manner similar to that used in 2-wire telephone repeater systems, so that the outgoing signals may not interfere with the incoming signals. Valve oscillators are used as generators.

Dollis Hill Experimental Work.—A considerable amount of work has been carried out at the Post Office engineering research station at Dollis Hill. As one-direction multi-channel working had already been definitely proved to be capable of satisfactory operation both in America and in Germany, the first trials were made with the application of both-way working on the same pair of wires. The results indicated that working in both directions on a pair of wires is a practicable proposition: the two extreme frequencies should be selected first, and, as the traffic demanded, converging channels would be introduced. Four channels in each direction, beginning at, say, 425 cycles on the low side and with 1,955 cycles as the highest value on the upper side, would appear possible on our British cables for start-stop apparatus speeds.

Owing to storm breakdowns in the aerial circuits connecting the radio beam stations in Tetney and Skegness with London, and the possibility of these stations being utilised for radio-telephony, the provision of loaded underground cables has been under consideration; they would have to carry the existing high-speed telegraph circuits. The method hitherto in use in this country for this purpose would have been to reserve a certain number of unloaded pairs, probably of heavier gauge than the telephone pairs, and work them with d.c. and perhaps with telegraph repeaters at Leeds. As already indicated, this practice is liable to produce noise in the telephone pairs and, when it is remembered that the pairs would be used for international telephony, such a scheme could not be defended. Telegraph speeds of 200 w.p.m. are demanded to cope with the speed and exigencies of the beam traffic. A voice-frequency system was devised at Dollis Hill to meet the demand and a single-channel set without filters was set up and tried on existing loaded cables and on the actual circuits that would be used. The results were as follows:—

Circuit.	Voltage impressed on line.
Dollis Hill-Fenny Stratford-Dollis Hill (108.40 miles) ...	0.4
Dollis Hill-Grantham-Dollis Hill (354.44 miles) ...	0.25
Dollis Hill-Catterick-Dollis Hill (509.44 miles) ...	0.25

Telephone repeaters at	Speed w.p.m.
Fenny Stratford	350
Fenny Stratford, Derby (go and return)	300
London (TSX), Fenny Stratford, Derby-Leeds (go and return)	300

Systems in Practice.—The application of the voice-frequency system to commercial use to-day may be summarised briefly as follows:—

Germany.—Main routes are now mainly operated on this system, voice-frequency lines and channels radiating from Berlin and other large centres.

United States.—By the end of 1928 some 40 voice-frequency circuits, each of 12 channels, were to be in operation. The average length of the circuits is from 400 to 500 miles, so that there are about 200,000 channel-miles in use, which is approximately one-fifth of the total telegraph milage of the American Telephone and Telegraph Co. The system so far has been restricted to extra-light-loaded [No. 19 gauge (20 lb.)] 4-wire circuits, with telephone repeaters spaced about 50 miles apart.

France.—The following circuits are in use:—

1 quadruple Paudot:—Le Havre-Paris-Hamburg.
1 triple duplex:—London-Paris-Berne-Zurich.
1 double duplex:—London-Paris-Basle.
1 Hughes:—Paris-Fechamp.

England.—London-Manchester, six channels each way; London-Leeds, six channels each way.

The International Consultative Committee has laid down the following recommendation: the sum of the effective voltages corresponding to the frequencies used simultaneously over the same circuit should be less than 2 volts, and the sum of the effective currents corresponding to the frequencies used simultaneously over the same circuit should be less than 2 mA. When it is required to use currents or voltages greater than the above values, it is desirable, for preference, to choose the circuits allotted to telegraph purposes in outer layers of the cable and to balance them in separate groups. No difficulty has been found in working within the limits of current and voltage prescribed above.

The Committee has also received a proposal for the selection of telegraph frequencies to be used in loaded telephone cables and (*a*) has recommended for cables the use of frequencies of harmonic multiple telegraphy instead of separate wires; (*b*) has suggested that it would be very desirable to have standardised frequencies for harmonic multiple telegraphy. The proposed figures of frequencies submitted for approval have not yet been formally adopted. It is proposed to employ voice-frequency operation for international traffic on loaded cables, and a study is being made to determine what output it is possible to obtain from the circuits with start-stop apparatus, Siemens high-speed telegraph, and multiplex apparatus.

No direct comparison can legitimately be made between the various countries, since the conditions are not alike in all. In this country telegraph traffic is diminishing and there is an annual loss on the service of some 1½ million pounds. There are sufficient channels (of a sort) to carry the traffic, and one naturally hesitates before recommending the expenditure of additional capital under such conditions. In the Hardman Lever Committee's report of January, 1928, the average price paid per telegram is given as 14.76d., while the cost amounts to 22.14d. Of this amount 15.24d. is absorbed in administration and management, operating, delivery and sub-postmasters' allowances for telegraph work, while maintenance and depreciation of plant and interest on capital amount to 2.58d. Parliament has laid down a uniform charge for telegrams in the United Kingdom, irrespective of distance and of the number of re-transmissions. It would appear to the author that the most promising field for the introduction of a voice-frequency system in this country would be to utilise the many channels on a pair of wires which the system can provide, for the purpose of eliminating as far as possible the "X" message, *i.e.*, a telegram that has to be re-transmitted by hand at an intermediate office or offices. In the industrial midlands, north and west countries, there are many groups of large towns, congregated round a larger centre, which form the re-transmitting centres to and from the others. The telegraphist is the most costly item of the equipment and every re-transmission adds very appreciably to the cost, and incidentally also to the delay.

Any one channel can be extended to operate direct-current apparatus on an existing line, and there must be many towns between which there is appreciable traffic without direct communication. The introduction of voice-frequency working between large centres with extensions carried on spare wires in the underground networks, or on open lines, would provide direct service between many towns which does not exist at present. Single channels extended and operated at key speed can be composited readily on existing telephone trunk circuits, and, if need be, the channels can be terminated on concentrator switches and plugged through as required. Start-stop apparatus on, say, 4 channels of a 6-channel 2-wire circuit could carry the direct traffic between the larger centres and thus avoid synchronisation and brush troubles which require skilled and highly-paid attention on rotary multiplexes, while the other two channels could be utilised as morse circuits for extensions. The whole process would tend towards the reduction of the re-transmission operating costs and it is considered that the 15.24d. factor in the total expenditure could be lowered at a greater rate than the 2.58d. would increase.

The author holds no brief for the system; its general adoption in this country could be justified only by a reduction in operating costs and by the general improvement of transmission in cables carrying both telephone and telegraph circuits. A considerable additional expenditure per circuit per station would be involved (since the actual instrument-room equipment would still be required), but in the direction already indicated, and also in the gradual recovery of purely telegraph cables and the shutting down of telegraph repeater stations, increasing savings could be effected and a more efficient operation of and larger earning capacity obtained from the Department's line plant as a whole.

Discussion in London.

Col. T. F. Purves, O.B.E., vice-president, occupied the chair.

Mr. E. Shaughnessy opened the discussion by remarking that he knew of no reason why good buzzer signals should not be as good as those produced by a sounder. Thermionic valves had been used for converting a.c. in wireless long before the 1914-18 European war; what the author meant was that they had not been used in land-line circuits. His fig. 4 did not convey a correct picture of the envelope, as the e.m.f. and current scales were not quite clear. Did not sending filters add to the cost? Also six channels on four wires did not seem to be too economical. At what distance would it pay to use the voice-frequency system, compared with installing direct wires?

Mr. G. C. Marris observed that a variety of systems could be devised for different ways of operating them also; which was the best for use in this country? There were about a dozen methods of converting, or rectifying, the signal, which subject might form a separate paper by itself. In amplification of the author's filter curves, he showed an oscillograph record of a transient in a 400-cycle band filter.

Lieut.-Col. A. G. Lee thought the author's picture attractive, but there were difficulties in fitting in and switching on individual messages. The operator time would be increased, and too many channels were not desirable, for not more than six were needed in any one instance. On very long lines, no doubt multiplex operation paid for itself, but it was not economical on short lines; compositing was not complicated, was stable and could be used over telephone circuits. The voice-frequency system cost about the same as compositing, but it needed two pairs of wires, the cost of which was several times that of the terminal apparatus. Voice-frequency operation would only be economical in this country where compositing could not be employed, but both those systems were attractively stable, compared with multiplex operation.

Mr. A. E. Thompson considered the system uneconomical, as it did not secure maximum operator time, a most expensive item. It was itself a duplex system, and it was bad engineering to so divide up frequencies as to necessitate the introduction of additional apparatus to make proper use of the facilities available. A multi-frequency generator was preferable to separate valves; thermionic apparatus was costly and needed the sole use of telephone facilities, but the system was suitable for very heavy traffic over very long lines.

Mr. E. S. Ritter pointed out that in some cables special pairs had been set aside for telegraphy, but never used, and they could be made up for telephony. They never would get "something for nothing," and if compositing were adopted it would involve changing the telephone ringing periodicity.

Mr. J. M. Olven explained that on very long lines, some 890 miles, it had been possible to work perfect teletype.

Mr. V. J. Terry said that the Küpfmüller bloomer was again being given prominence. His building-up value was calculated on the basis of a perfect, ideal filter, and the fact that his expression had been verified by experiment was misleading, for the experiment happened to be favourable.

Mr. W. Cruickshank, in reply, maintained that telegraphists did not like buzzer signals, and could not go on reading 50's for eight hours. He could not agree with Mr. Shaughnessy's channel definition, for any communication system required both sending and receiving channels, and it was too much to expect 48 channels per pair of wires. The compositing system cost money and space.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

London Trunk Power Cables.

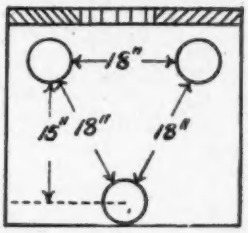
Mr. K. Bell raises the following objections:—Item 1, that cables must inevitably be laid in a tortuous path to avoid other obstructions. I, however, who have had working experience of the laying of high-voltage cables, both in London and other towns, do not find the same conditions as Mr. Bell relates.

There should be no occasion, if the trench is properly prepared, to lay a cable in anything but a fairly straight course, except, of course, where it is necessary to change direction, such as for crossing a road, &c., and even then a wide sweep is taken to minimise any possible cause of trouble. Engineers responsible to their respective cable companies are usually men who do not take any undue risks with cables. Some extra-high-voltage cables have now been laid a considerable time without breakdown, but they are armoured.

Mr. Bell further comments on the use of a ¼-in. mesh sieve (or riddle) for bedding and covering the cables, but my experience is that when a cable is laid at reasonable depth damage is not possible with pebbles of this size. If a smaller mesh sieve were used, it would be a most laborious job with some classes of soil, especially if the cables were laid during the winter months when the soil is usually damp. All cable engineers realise the need for keeping cable trenches free from falling and large pebbles, and where this is likely to occur the sides of the trench are close-boarded.

The usual method of covering cables for protection with concrete covers marked "Electricity," appears to be quite satisfactory; but I do not favour wooden protective covering. Mr. Bell states that the slightest touch with a pick would penetrate a cable, but this is hardly the case, as it would require a fairly heavy blow to damage the sheath, and then there is a possible ½ in. of dielectric to penetrate before the core is reached.

With regard to the formation of the cables to be laid, it appears obvious that the triangular disposition is used to minimise trench width and, at the same time, to give the greatest radiating distance for the cable; but it is presumed that one cable will be laid at the bottom in the middle of the trench, then a soil separating medium of, say, fifteen inches, and then the two other cables will be drawn in, as shown in



Disposition of Cables in Trench.

the accompanying illustration. Cables are usually laid in this fashion to minimise the replacement of costly paving, and it is more desirable, in this sense, for a narrower trench means less obstruction by other concerns' mains.

Laying cables in open trenches is obviously a much cheaper proposition than drawing them into ducts. First, it would be extremely difficult to draw a Hessian-covered cable into ducts, and even if it had an exposed lead covering the maximum length of cable it would be possible to draw-in with safety would be one hundred yards, whereas, when laid direct, from one hundred and seventy-six to two hundred yards could be laid by using the usual cable rollers common to cabling jobs; but the most important point is that by drawing cables into ducts one increases the number of joints by nearly 100 per cent., and the weakest point in any cable is the joint.

Resident Engineer.

February 19th, 1929.

Overhead Electric Lines.

Will you please allow me space to accurately present mal-interpretations of mine on page 247 of the I.E.E. *Journal* (Vol. 67, No. 386) of February, 1929. In the first column . . . "His tests are quite as important as those described in the present report, because they give the limit for a rigid base, whereas the present report gives the same tests" . . . should read "The Wade tests are more important than those described, because they give the true internal moment of pole by using a rigid base, whereas the present report gives certain tests for . . ."

Also, in the second column (same distance up the page) . . . "If we want to get the maximum strength, not maximum possible bending moment" . . . should read "If we want to get the maximum strength, or maximum possible bending moment. . . ."

It would also seem necessary to add that my remarks had nothing to do with the use of sawn wood, nor with concrete foundations, and about as little with stays. They refer almost exclusively to the testing of a wood pole, or a frame, so that its true strength is obtained. Surely Mr. W. B. Woodhouse does not recommend sawn timber for a pole, which latter is one leg of a frame? Surely he does not consider a wood pole foundation (such as concrete) that completely stops drainage and ventilation from the pole to be satisfactory? And, surely he would stay, or stub-stay, or strut, or support in some way, a pole, or a frame, subjected to the lateral pull (or a longitudinal pull) of the character referred to in the paper as actual practice, &c.; and, surely he would divert any such dangerous point of the line where it is impossible to support it for any reason whatsoever? Surely, good practice can be interpreted as the highest strength at reasonable cost, and highest strength surely means greatest safety? Hence, interpreting the three conditions mentioned, is it not evident that the best practice demands that we use the natural grown and trimmed and treated tree, not sawn timber; avoid any type of foundation that rapidly causes decay, or rapidly decreases the pole-timber factor of safety, such as a solid concrete foundation does; and always use supports (stay, or stub-stay, or stub, or any other means) where the transverse force is of the nature referred to by Mr. Woodhouse. These three conditions would therefore seem to differ widely from his views.

William T. Taylor.

London, N.2, *February 22nd*, 1929.

Gramophone Reproduction.

My feeling of annoyance at Mr. P. K. Turner's original criticism of my article was, I feel, justified by the fact that he had apparently made his criticism on purely superficial summarising instead of careful reading. As a case in point, Mr. Turner, in his second letter, tells us that "the latest information in his hands (with reference to recording) is that constant output is maintained down to 150 cycles and constant amplitude below that frequency." I suggest that Mr. Turner might have learnt this earlier if he had read my article (page 140, bottom of column 1). "In practice it is not possible . . . energy output a rising characteristic."

As regards my suggestion that Mr. Turner's letter was of an advertising nature, if the idea of publicity was not intended, I freely apologise, although surely Mr. Turner is sufficiently well known for his name to be enough on a letter of this nature.

In my criticism of Mr. Turner's loud-speaker, I stated (perhaps a little crudely) that the only confirmation of the claims made, which had come to my notice, was through the medium of advertisements. Surely Mr. Turner does not expect me to accept the inclusion of his claims on such evidence? My criticism of the loud-speakers themselves is made in all good faith, on the very small experience stated, and I cannot retract my opinion until convinced to the contrary.

Whilst agreeing with Mr. Turner about the difficulties of sufficiently overcoming a tendency to back-coupling, I prefer to employ a more reliable means of prevention, when necessary, than that of a choke-fed transformer. The question of the steady d.c. through the primary of an output transformer being an unwanted factor is one on which I disagree, even at the risk of being considered out of date.

In conclusion, I would like to thank Mr. Turner for the courtesy of his letter, and trust that he will accept the foregoing remarks as being written with the same courteous intention.

Ernest W. Braendle.

Blackheath, *February 16th*, 1929.

Catalogues.

Mr. H. R. Taunton, in his very interesting article on "Catalogues" in your number of February 15th, asks why, if the E.C.A. sanctions net trade price lists for wires and cables, it should be averse to net trade price lists for conduits, &c.?

In 1912 we commenced issuing to the trade only a net price list of cables, conduits, and wiring accessories—no fittings, no illustrations—so that it could only be of interest to actual trade users. Being an inexpensive list, when prices of cables or conduits changed we were able to issue an entirely new list. This has happened on an average three or four times per year since 1912. Our contractor friends (many of them members of the E.C.A.) appreciated this list, and said how useful it was to them when estimating, to have a list of current net prices to work with.

The E.C.A. took exception to our net list, and though we assured it we had no wish to publish a list that was detrimental to the electrical contractor, from whom we obtain 80 per cent. of our business, and, further, that we contended that net price lists of conduits, switches, fuseboards, &c., unillustrated, were of no more interest to people outside the trade than the net wires and cables price lists of which it approved, the E.C.A. still objected. So, to meet its wishes, since December our list prices have been gross and subject to standard discounts.

Some of our contracting friends are now asking us to revert to the practice of giving the net price for our goods. We still see no adequate reason why these should not be listed at net prices, except that the E.C.A. is too powerful for a factor to offend.

P. L. Dwyer & Co.,
P. L. Dwyer.

London, S.W.1.
February 13th, 1929.

The Regulation of Cookers.

I was interested in the letter last week from "Regulator" and agree with him that "electric cooking is not economical without a water heater."

With this conviction six years ago, after spending considerable sums of money experimenting, I obtained patents both in this country and America covering a "Combined Electric Cooker and Water Heater." I had sample apparatus made at the cost of about £10, which embodied a water-jacketed oven, using the heat of the oven to heat the water after cooking was completed, and also having a subsidiary immersion heater in the water jacket by which means "the potentiometer principle," mentioned by "Regulator," could be easily applied. The sample has been in use at my home ever since, and after each cooking period at least three buckets of nearly boiling water is obtained, the oven loading being practically the same as the present type of electric oven on the market.

I offered the idea to most of the electric oven manufacturers until I was tired of doing so, as it seemed hopeless to attempt to broaden manufacturers' views, which appear to be that "what was good enough for our grandfathers is good enough for us."

I remember one manufacturer's excuse was that the I.M.E.A. would not be prepared to consider any type that differed from the standard, but I think that Association is still looking for a "standard."

I am afraid the trouble is that manufacturers think "they know it all," but I suggest that an ideal electric oven is far from an established fact at present. You are at liberty to give my name to any correspondent who is really interested.

Combination.

February 23rd, 1929.

Prepayment Meters.

I would like to have your, or your readers', views on the following, arising from the installation of prepayment meters, particularly the strictly legal position relative thereto.

When prepayment meters are installed, special locks and seals are fitted in order that only the supply undertakers' officials can have access to the coins inserted for payment for electricity consumed. It would therefore appear that as soon as the coins have been inserted, both the property and the risk have passed from the consumer to the undertakers. If, therefore, the meter is broken open, and the money stolen, the undertakers would seem to have no right of redress against the consumer, unless it can be proved that the latter was the actual thief. A point which seems to strengthen this position is that it is entirely at the option of the undertakers whether the inserted coins are collected daily, weekly, monthly, or quarterly.

The recovery of expenses in connection with damage to the meter also raises an interesting point. In this case also, it would seem that no action can be taken against the consumer, unless proof is forthcoming that he, or she, was the actual person causing the damage, or who suffered the damage to be caused. A clause similar to the following is usually inserted in the terms and conditions under which a supply is given:—

"The consumer is responsible to the undertakers for all damage done to their property, which may be laid, placed, or fixed, in or on consumer's premises. Consumers are recommended to insure this against fire."

Is the foregoing clause sufficient to give the undertakers the necessary authority to recover from the consumer the equivalent of stolen coins, and expenses in connection with the repair to the damaged meter, irrespective of who may have extracted the coins, or who may have caused damage?

Coin Register.

February 22nd, 1929.

Conditions in Bagdad.

I should be much obliged if any of your readers could give me up-to-date information about the cost of living in Bagdad for a man and his wife. Any further information as to climate, clothing, and general living conditions will be much appreciated.

Bagdad.

February 25th, 1929.

[Pressure on our space has necessitated several letters being held over.—Eds. Elec. Rev.]

Legal.

Fraudulent Consumption of Electricity.

A householder who used electricity for lighting from the heating circuit was fined £5 at Fleetwood on February 20th. A meter inspector said that he noticed a light in the front room. After taking the meter readings he switched off the power circuit, and there was a cry from someone in the room that the light had gone out. Defendant was seen by Mr. W. P. Lilwall, the electrical engineer, and he admitted having used the power circuit for a reading lamp. He said that he had no intention of defrauding.

At Blackburn on February 22nd, Harry Kenyon, watchmaker and jeweller, Penny Street, was fined £5 for fraudulently consuming electricity. Mr. C. S. Robinson, prosecuting, said defendant had been using electricity supplied through the power circuit for lighting purposes.

British Thomson-Houston Co., Ltd., v. Isow and Finegold.

In the Chancery Division on February 19th, Mr. Justice Clauson, on a motion for judgment in default of appearance and defence, granted an injunction to the British Thomson-Houston Co., Ltd., restraining J. Isow, of Alvington Road, Hackney, and A. L. Finegold, of Blakesby Road, E., from infringing two of its incandescent electric lamp patents, and passing off.

His Lordship also made an order for the delivery-up of infringing lamps.

Mr. Tookey, for the plaintiffs, said the particulars of sale referred to 44 cases of infringing goods.

British Thomson-Houston Co., Ltd., v. City Incandescent Light Co.

In the Chancery Division before Mr. Justice Eve on February 22nd, Counsel again mentioned this case in which his Lordship on February 15th granted *ex parte* an injunction restraining infringement of plaintiff's letters patent with respect to gasfilled lamps.

His Lordship asked if the defendant now appeared.

Mr. Nesbit said that he appeared for the defendant, and he would submit to the usual order and consent to treat the motion as the trial of the action. So far as the defendant was concerned, he appeared to be innocent. The lamps were not what he ordered, and when they were delivered he wanted to get rid of them, but he could not trace the agent to whom he gave the order.

His Lordship granted a perpetual injunction.

Glasgow Electricity Department's Accounts.

At the Glasgow Sheriff Court on February 24th, a petition was heard from a local ratepayer for the production by Glasgow Corporation of full details concerning the following items of the accounts of the Electricity Department :— Rents, rates, and taxes, £189,058; management expenses, £12,644; and outstanding revenue assets, £29,769. The items referred to the year ended May 31st last. Counsel for the petitioner said that at present it was a general challenge of the items, and afterwards it would be necessary for the Court to decide as to the legality of certain payments and other matters. The Corporation objected to the petition on the ground that the objections to the accounts were not sufficiently detailed to allow of their production at this stage. The Sheriff will issue his decision later.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1927.

362. "Electric fuses." R. H. D. Barklie. November 4th, 1927. (Addition to 265,263.) (305,243.)

19,150. "Electric heating devices." British Thomson-Houston Co., Ltd., H. W. H. Warren, and R. G. Green. September 11th, 1928. (305,160.)

20,195. "Amplifier device for use in conjunction with an electrostatic microphone, gramophone, or the like." H. Andrewes and Dubilier Condenser Co. (1925), Ltd. July 29th, 1927. (305,052.)

22,583. "Method of and means for recording sound on and reproducing sound from phonofilms." L. Mellersh-Jackson (Siemens & Halske Akt. Ges.). August 27th, 1927. (305,245.)

22,895. "Method for electric arc welding." M. Zack. May 25th, 1927. (Addition to 277,005.) (291,042.)

25,408. "Television and other signalling apparatus employing light-sensitive devices." J. J. Rowe and C. L. Rowe. September 26th, 1927. (305,079.)

25,426. "Frame aerials as employed in the art of wireless-telegraphy and telephony." B. Hesketh. September 27th, 1927. (305,109.)

25,471. "Apparatus for sirgeing of cloths and yarns." British Thomson-Houston Co., Ltd., and R. D. Given. September 27th, 1927. (305,110.)

25,721. "Electric switchgear." British Thomson-Houston Co., Ltd., H. Pearce, and E. D. Regis. September 29th, 1927. (305,055.)

26,086. "Apparatus adapted for use in radio-telegraphic direction finding and for similar purposes." R. A. W. Watt and L. H. Bell Bainbridge. October 3rd, 1927. (Addition to 252,263.) (305,250.)

28,311. "Electromagnetic reproducing and recording devices for gramophones." A. A. Linsell. October 25th, 1927. (305,058.)

28,323. "Combined kinematographic and sound-reproducing apparatus." H. J. Kuchenmeister. November 2nd, 1926. (280,188.)

28,493. "Electrical indicating instruments." Weston Electrical Instrument Corporation. September 16th, 1927. (297,093.)

28,496. "Thermionic valves." Edison Swan Electric Co., Ltd., and L. H. Soundy. October 26th, 1927. (305 063.)

28,774. "Coating articles." W. E. Beatty (Bell Telephone Laboratories, Inc.). October 28th, 1927. (305,084.)

28,800. "Thermionic valves." C. S. Franklin. October 28th, 1927. (305,251.)

28,827. "Methods of, and apparatus for, covering cores, particularly applicable for insulating cables." W. E. Beatty (Bell Telephone Laboratories, Inc.). October 29th, 1927. (305,085.)

28,861. "Electric relays." A. Reyrolle & Co., Ltd., and N. Cooke. October 29th, 1927. (305,069.)

28,896. "Push-pull connection for thermionic and like valves." Siemens and Halske Akt. Ges. October 30th, 1926. (279,899.)

28,904. "Microphones." A. Whitaker and Gramophone Co., Ltd. October 29th, 1927. (305,073.)

28,906. "Means for controlling the intensity of a beam of light for use, for example, in recording sound." W. H. Eccles, A. Whitaker, and Gramophone Co., Ltd. October 29th, 1927. (305,074.)

28,910. "Telegraphic receiving and transmitting apparatus." A. H. Marks and P. Russell (legal representatives of E. C. R. Marks) (deceased), and L. A. L. Horn. October 29th, 1927. (305,075.)

29,145. "Electric power-transmission controllers for locomotives and other vehicles." P. C. Saccaggio. November 1st, 1927. (305,156.)

29,172. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. November 1st, 1927. (305,158.)

29,175. "Milking machine having electrically-controlled pulsations." Aktiebolaget Separator November 17th, 1926. (280,893.)

29,179. "Machines for printing and issuing tickets." Siemens & Halske Akt. Ges. November 2nd, 1926. (280,207.)

29,245. "Electrical terminal boards." Siemens Bros. & Co., Ltd., W. E. Goodwin, and F. Baker. November 2nd, 1927. (305,256.)

29,287. "Gyro compasses." P. R. Jackson (Sperry Gyroscope Co.). November 2nd, 1927. (305,258.)

29,432. "Recording or reproducing of sound in talking kinematography." De Forest Phonofilms, Ltd. November 27th, 1926. (281,248.)

29,784. "Electrical coupling circuits for transmitting voice and like complex-frequency currents." W. E. Beatty (Bell Telephone Laboratories, Inc.). November 7th, 1927. (305,284.)

30,179. "Telephone systems with amplifiers." Siemens & Halske Akt. Ges. November 15th, 1926. (280,565.)

30,511. "Electric junction boxes." British Thomson-Houston Co., Ltd., C. J. Morton, and T. H. Woodfield. November 14th, 1927. (305,296.)

30,836. "Horns for loud-speakers, gramophones, and other sound-regenerating apparatus." M. Ward. November 16th, 1927. (305,301.)

30,846. "Pasting of electric accumulator plates." C. A. Vandervell and Co., Ltd., R. C. Paterson, and P. J. Beddous. November 17th, 1927. (305,302.)

32,110 "Method of, and means for, controlling polyphase induction motors." R. B. Hunter. December 15th, 1926. (282,368.)

32,419. "Tap-changers for electric transformers." W. A. Coates, J. Fowler, and Metropolitan-Vickers Electrical Co., Ltd. December 1st, 1927. (305,318.)

32,694. "Radiographic apparatus." R. K. Hezlet, V. E. A. Pullin, and A. G. Warren. December 3rd, 1927. (305,322.)

32,731. "Loud-speaker diaphragms." J. Wilson. December 5th, 1927. (305,323.)

33,223. "Combined automatic and manual electric circuit controllers." British Thomson-Houston Co., Ltd. December 13th, 1926. (282,074.)

33,421. "Electrically-driven timepieces." H. Bold. December 10th, 1927. (305,327.)

34,091. "Gas vents for electric accumulators." Pritchett & Gold and E.P.S. Co., Ltd., and C. R. D. Pritchett. December 16th, 1927. (305,330.)

34,210. "Fixed contacts of electric tumbler switches." J. A. Crabtree. December 17th, 1927 (305,332.)

34,414. "Battery-charging systems and control relays and circuits for use in such systems" H. E. Bucklen. December 19th, 1927. (305,335.)

35,228. "T-shaped joint for electric cables." T. Yamanouchi. December 29th, 1927. (305,345.)

35,430. "Electric globe holders." A. McKellar. December 31st, 1927. (305,348.)

35,446. "Selective relays, particularly for electric protective systems." International General Electric Co., Inc. December 31st, 1926. (282,838.)

1928.

802. "Carrier-arms for electrical pick-up devices for sound-reproducing machines." Consulting & Radio Service, Ltd., and N. Turner. January 10th, 1928. (305,354.)

1,107. "Telephone systems." Associated Telephone and Telegraph Co. March 14th, 1927. (287,079.)

1,146. "Electrical switchgear." D. R. Davies and Metropolitan-Vickers Electrical Co., Ltd. January 12th, 1928. (305,356.)

2,260. "Means for regulating the strength of sound in photo-electric reproduction from sound films." H. J. Kuchenmeister. January 27th, 1927. (284,285.)

2,834. "Detection of variations in the frequency of high-frequency oscillations." Elektromekano Aktieselskabet. January 28th, 1927. (284,356.)

3,078. "Connection of the ends of oil-filled hollow cables." Siemens-Schuckertwerke Akt. Ges. March 29th, 1927. (287,893.)

6,589. "Induction furnaces." E. F. Russ. March 2nd, 1928. (305,388.)

7,374. "Electric supply and distribution systems." W. Frensdorff and Deutsche Schiff und Maschinenbau Akt. Ges. March 9th, 1928. (305,393.)

7,430. "Vehicle lamps." J. Pintsch Akt. Ges. March 14th, 1927. (287,088.)

8,052. "Automobile head lamps." O. Jensen. March 16th, 1928. (305,397.)

10,375. "Refrigerator cabinets." British Thomson-Houston Co., Ltd. April 12th, 1927. (288,576.)

10,740. "Arrangement for the automatic regulation of the efficiency of transmission systems, particularly of high-frequency transmission systems." August 31st, 1927. (Patent of addition not granted.) (296,397.)

11,484. "Single and multi-phase commutator motors." J. Sousedik. June 27th, 1927. (292,942.)

12,985. "Heat-operated electric switch." G. Richardson. May 3rd, 1928. (305,420.)

13,802. "Electric drives for paper machines." International General Electric Co., Ltd. May 10th, 1927. (290,226.)

13,825. "Negative electrode for zinc electric accumulators." A. Pouchain. January 10th, 1928. (303,823.)

13,826 "Lead electrode for electric accumulators." A. Pouchain. January 10th, 1928. (303,824.)

14,009. "Grip for electric cables." P. F. Hellermann. May 31st, 1927. (291,376.)

16,656. "Electric fuses." F. Whipp and Whipp & Bourne, Ltd. June 8th, 1928. (305,428.)

16,742. "Electrically-operated vibratory devices such as are used in the recording or reproduction of sound." M. Trouton and Wireless Music, Ltd. January 30th, 1928. (Divided application on 293,131.) (Cognate application 18,676/28.) (305,429.)

21,448. "Filaments for electric incandescent lamps." Falk, Stadelmann and Co., Ltd. November 23rd, 1927. (Addition to 297,052.) (301,014.)

22,544. "Joining of sheet metal by electric welding." British Thomson-Houston Co., Ltd. August 8th, 1927. (295,281.)

25,277. "Radio and the like receivers." Marconi's Wireless Telegraph Co., Ltd. September 1st, 1927. (296,678.)

29,243. "Boxes or containers of mechanism for electrically operating tramway or railway points, switches, and the like." S. T. Quilliam. October 11th, 1928. (305,447.)

34,385. "Electric clocks." F. Conrad. March 17th, 1927. (Divided application on 287,182. (300,992.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from the dates mentioned :—

FEBRUARY 13th.

Anhydrene. No 498,281. Class 50. Electrical insulating preparations.—Berry, Wiggins & Co., Ltd., Channelsea Road, Stratford Market, E.15.

FEBRUARY 20th.

Tefag, Continental (lettering and design). No. 492,017. Class 8. Telephonic and telegraphic instruments and apparatus and parts thereof.—Die Telephonfabrik Berliner Gesellshaft, Berlin. (British representative : A. A. Thornton, 7, Essex Street, Strand, W.C.2.)

Voltex, Made in Germany (lettering and design). No. 493,844. Class 8. Electric dry batteries (not for medical purposes).—M. F. Bockh, 234, Perry Hill, Catford S.E.6.

Selecta (lettering and design). No. 493,936. Class 8. Radio-telephonic receiving sets and apparatus.—Selecta Gramophones, Ltd., 81, Southwark Street, S.E.1.

Phonotrol. No. 494,497. Class 8. Instruments and apparatus for use in radio-telephony and telegraphy.—Igranic Electric Co., Ltd., 147, Queen Victoria Street, E.C.4.

Stradonelle. No. 497,087. Class 8. Sound reproducing and recording apparatus and instruments and apparatus for use in radio-telegraphy and telephony and parts thereof.—A. J. Balcombe, Ltd., 51, Tabernacle Street, E.C.2.

Movex. No. 497,587. All goods in Class 8, but not including thermionic valves, electric discharge tubes and other similar vacuum tubes.—I. G. Farbenindustrie Gesellschaft, Frankfurt-am-Main. (British representatives : Abel and Imray, 30, Southampton Buildings, W.C.2.)

Beta. No. 496,093. Class 13. Electric lamps (ordinary).—J. W. Naylor, 53, Lancaster Gate, W.2

Electra. No. 498,358. Class 15. Glassware.—I. S. Greenberg & Co., Ltd., 125, Great Hampton Street, Birmingham.

Jacelite. No. 489,391. Class 16 Electrical insulators made of porcelain and earthenware.—J. A. Crabtree & Co., Ltd., Lincoln Road, Walsall.

S.P. (lettering and design). No. 498,902. All goods in Class 16.—Steatite and Porcelain Products, Ltd., 56, Victoria Street, S.W.1.

Electro Lux (lettering and design). No. 493,884. All goods in Class 18, but not including electric lighting and ignition sets for motor vehicles.—Electrolux, Ltd., 153-155, Regent Street, W.1

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERDEEN.—Improvement scheme at Beach, including scenic railway; city architect.

ARGYLL.—Rebuilding cattle-food factory at Cardwell Bay; ex-Provost H. McCowan, Oban.

AYR.—Stores and finishing rooms, for W. C. Gray & Sons, Newton Carpet Mills (£8,000); the manager. Shops and garage (£2,400), for J. Robertson, motor engineer, Fotheringham Road.

BATLEY CARR (Yorks.).—Works and offices, Upper Road, for Joseph Brooke & Sons.

BEDWAS.—Senior school, Trethomas, for Monmouthshire E.C.; director of education.

BOURNE END.—Housing scheme (30), for High Wycombe R.D.C.; Charles H. Wright, architect, 24, Temple Street, Aylesbury (returnable deposit of £2).

BRANSTON (Lincoln).—Additional 86 houses, for the R.D.C.; surveyor.

BRIDGWATER.—98 houses at Victoria Road housing estate; Samson & Colthurst, architects.

BURSLEM.—Warehouse, Waterloo Road; T. & R. Boote, Ltd.

BURY.—Housing scheme (88 flats, 122 houses); borough surveyor.

CHADDERTON (near Oldham).—Extension of sewage disposal works (deposit £2 2s.); J. Diggle & Son, engineers, Hind Hill Street, Heywood.

CHADWELL HEATH (Essex).—Works extensions, Metropolitan Cable Co., Ltd.; F. Smith, architect; N. J. Cearns, builder, Stratford, E.

CHARTHAM.—Operating theatre, Mental Institution; Kent C.C.

CHEAM (Surrey).—Church; Rev. Canon H. Wesley Dennis, rector.

CROYDON.—Rebuilding and extending post office, for H.M. Office of Works, King Charles Street, London, S.W.

DEAL.—Police station, London Road (£6,000); Kent Standing Joint Committee.

DRIFFIELD (Yorks.).—Hospital (£6,000), for the Cottage Hospital Committee; secretary.

DUNDEE.—Mill, for Baxter Bros., jute manufacturers; the manager.

EDINBURGH.—School at Gorgie Road (£10,000), for education authority; master of works. Junior department for Royal High School (£36,865); Reid & Forbes, architects.

ELLESMERE PORT.—Extensions, cottage hospital; T. W. Francis, hon. sec., Council Offices (returnable deposit of £2 2s.).

EPSOM.—Nurses' home, Mental Hospital (£24,500); L.C.C. architect.

FIFESHIRE.—Special school and hostel at Halbeath (£30,000); master of works, Education Authority, Kirkcaldy.

FULBOURN.—Works at mental hospital (£10,664); Isle of Ely C.C.

GALSTON.—Hosiery factory, Titchfield Street, for James Prentice.

GLASGOW.—204 houses, Saracen Street site; housing director and trade contractors.

GOLBORNE.—Housing scheme (32), for the U.D.C.; H. Eckersley, clerk (returnable deposit of £2 2s.).

HALIFAX.—Model bakery, for the Economic Stores, Ltd.; G. R. Oddy, architect, Ward's End Chambers.

HANLEY.—Extensions, printing works, Trinity Street and Foundry Street; Staffs. Sentinel, Ltd.

HARROGATE.—Housing scheme (50), for the T.C.; borough surveyor.

HARTSHILL (Staffs.).—Operating theatre, Royal Infirmary; governors.

HORNCHURCH (Essex).—Houses (46), for T. A. Clarke; Houses (44), Grey Towers estate, for C. A. Piper.

INCE (Wigan).—Plaza Kinema, for the Union Playhouses, Ltd.; W. Cyril Sykes.

KIDDERMINSTER.—Works extensions, for Hurcott Paper Mills, Ltd. Premises, Castle Road, for Brintons, Ltd., carpet manufacturers.

KNARESBOROUGH.—Alterations to the Institution and Union offices; S. Blenkhorn, architect, Westminster Bank Chambers.

LEIGH-ON-SEA (Essex).—Cinema (£23,500), Leigh Road, with electrical and heating work; J. Saunders, architect, Westcliff, Southend-on-Sea.

LINCOLN.—School, Hampson Street (£15,250), for the Education Committee; W. G. Watkin, architect, Silver Street.

LIVERPOOL.—Extensions, with storage shed, Princes Dock; Mersey Docks and Harbour Board.

LONDON (Becontree, E.).—1,151 houses, Barking section, Becontree estate (£610,000); L.C.C. architect.

(E.C.).—Rebuilding *Punch* offices, Bouverie Street; Thompson & Walford.

(S.E.).—New St. Andrew's Church, Burnt Ash Lane (£8,500), with electric light and heating work; Rev. J. M. T. Griffiths, vicar.

(Greenwich, S.E.).—Housing scheme (79), Charlton Park, for the T.C.; borough engineer (returnable deposit of £2 2s.).

(Lewisham, S.E.).—Town hall extensions (£125,000), for the T.C.; town clerk.

(Piccadilly, S.W.).—Alterations, London Pavilion, Piccadilly Circus; G. T. Coote.

(Soho, S.W.1).—Additions, Royalty Theatre, Dean Street; R. Cromie.

(Westminster, S.W.).—Shops and flats, West Chapel Street and Market Mews; S. Burgoyne.

(Covent Garden, W.C.).—Improvements, Opera House; Covent Garden Opera Syndicate, Ltd. Market buildings, Tavistock Street; Covent Garden Properties, Ltd.

(Holborn, W.C.).—Extensions, Hospital for Sick Children, Great Ormond Street; Governors.

(Ealing, W.).—136 houses, Hurley Road, Keats Lane, Queen's Avenue, Mansell Road; H. S. Bostock, architect, Broadway Chambers, Southall; G. Wimpey and Co.

LONGTON (Staffs.).—Reinstatement (after fire) of the Royal Art Pottery Works, Waterloo Street, for Aynsley, Ltd.

LOWESTOFT.—Extensions, boat-building shop, Lake Lothing; J. W. Brooke & Co., Ltd.

MORECAMBE.—44 houses, Albert Road; Wm. Gardner and Co.

PERSHORE.—School, Croome estate, for Worcestershire E.C.; director of education, Worcester.

RAMSGATE.—Electric lamps, electric cable, strip lighting material, switchboards, &c., for bandstands, concert halls, &c., for the T.C.; R. J. Costerton, entertainments manager, West Cliff Concert Hall.

READING.—Additional 111 houses, for the T.C.; borough surveyor.

RICHMOND (Surrey).—Cinema and café, Bridge Street; C. Aish, architect, 22, Bedford Street, W.C.

RUSHDEN.—Housing scheme (42), for the U.D.C.; J. W. Lloyd, surveyor.

ST. HELENS (Lancs.).—Senior school, Parr, for the borough E.C.; secretary.

SALFORD.—Hotel, Broughton (£24,000), for Groves and Whitnall, Ltd.

SALISBURY.—Housing scheme (52), for the T.C.; W. J. Goodwin, city engineer (returnable deposit of £2 2s.).

SOUTHEND-ON-SEA.—High school for girls (£59,400), and extensions, Westcliff High School for Boys (£6,000), for the borough E.C.; director of education.

STIRLING.—Police buildings, Spittal Street (£9,875); chief constable.

STOCKPORT.—Billiard hall, Southwood Road, for William Millward, Jun., 10, Mytton Street, Hulme, Manchester. Housing scheme (114), for the T.C.; borough surveyor.

STOKE-ON-TRENT.—Shops, café, and dance hall, Church Street; Stoke Finance Co.

STOURPORT.—Houses (100), for the Steatite and Porcelain Products, Ltd.

STRATFORD-ON-AVON.—Extensions, King Edward VI Grammar School; A. C. Bunch, architect, 27, Binswood Avenue, Leamington Spa (returnable deposit of £2 2s.).

SWANSEA.—Extensions, Mumbles Cinema; T. E. Merrells.

SWINTON (near Rotherham).—Sewage disposal works; W. H. Radford & Son, engineers, Albion Chambers, King Street, Nottingham.

TAMWORTH.—Housing scheme (90), Mile Oak, for the R.D.C.; H. L. Kent, surveyor (returnable deposit of £3 3s.).